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EXPLORATION OVERVIEW

Mining, Exploration and
Geological Investigation

NORTHWEST TERRITORIES 1987

GEOLOGY DIVISION
NORTHERN AFFAIRS PROGRAM
YELLOWKNIFE, NWT

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PART 1: Mining and Exploration Overview, 1987

INTRODUCTION

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EXPLORATION HIGHLIGHTS

It is estimated that about $69 million was spent on exploration in the NWT in 1987, more than double the amount spent last year. Included in this amount are expenditures of $10 million on development of the Colomac and Ptarmigan properties (described below). Gold was again the main exploration target, with about $61 million spent on the search for this commodity.

Base-metal exploration was mainly confined to areas around producing mines, including Pine Point, which ceased mining at the end of June, but will continue milling through the end of 1988.

Uranium exploration has become the preserve of a few foreign-owned energy companies. CEGB worked on and around the Long Tom Lake showing in the Bear Province. PNC and Urangesellschaft continued work in the Keewatin, where the Kiggavik (Lone Gull) deposit absorbed a significant proportion of the NWT's uranium exploration expenditures.

A number of junior companies looked for platinum-group metals (PGM). The search is mainly in Proterozoic rocks including those of the Muskox Complex, and ultramafics in the Rutledge Lake, Rankin Inlet and Ferguson Lake areas. Most ultramafic rocks reported in the NWT have now been staked for their PGM potential.

A small amount was spent searching for rare elements such as beryllium, lithium, gallium and germanium.

Table 1 (preliminary) shows the distribution of projects and expenditures according to commodity and region.

TABLE 1: 1987 NWT EXPLORATION PROJECTS BY COMMODITY AND AREA

LEGEND: 82 (48) = total projects (drill projects)
$42.955 = expenditure in millions

COMMODITY / DISTRICT	GOLD	URANIUM	BASE METALS	PLATINUM	RARE ELEMENTS	TOTALS
SLAVE	82 (48) $42.955		1 (0) 0.05		1 (1) $0.15	84 (49) $43.075
KEEWATIN	13 (6) $17.42	2 (1) $3.1		2 (1) $0.55		17 (8) $21.07
BEAR		1 (0) $0.40		2 (1) $0.45		3 (1) $0.85
CORDILLERA	1 (1) $0.15				1 (0) $0.15	2 (1) $0.30
ARCTIC ISLANDS			1 (1) $1.0			1 (1) $1.0
PINE POINT			1 (1) $2.0			1 (1) $2.0
OTHER	2 (0) $0.065			1 (1) $0.48	1(0) $0.02	4 (1) $0.565
TOTALS	98 (55) $60.51	3 (1) $3.50	3 (2) $3.05	5 (3) $1.48	3 (1) $0.32	112 (62) $68.86

GOLD EXPLORATION SUMMARY

Exploration expenditures for gold in the Northwest Territories rose from approximately $25 million in 1986 to an estimated $61 million in 1987. At least 98 exploration projects were conducted, mainly in the Archean Slave Structural Province ($43 million) and in Archean greenstone belts of the Keewatin District ($17 million).

In the Keewatin, most work was concentrated in the 350-km-long Rankin-Ennadai greenstone belt. Borealis Exploration Limited explored the Fat Lake Zone from underground and plan to extract and mill a 3,000 t bulk sample. Drilling was conducted by Noble Peak Resources, Sunmist Energy, Canadian Nickel Company and Homestake Development, and smaller grassroots programs were done by at least three other companies.

The following describes the more important Slave Province projects done in 1987. In the Courageous Lake area, GETTY RESOURCES and NORANDA EXPLORATION spent

more than $8 million drilling to outline the Fat Zone, which is hosted in sheared felsic volcaniclastics. Results of deep drilling (+500 m) are reported to be as encouraging as those of shallower drilling (150 m) which outlined reserves of about 1.25 million grading 9 ppm gold. A $25 million underground exploration program is planned in 1988-1989.

Also in the Courageous Lake area, GIANT BAY RESOURCES LIMITED successfully completed a 10 tpd test bioleach of refractory ore from Giant Yellowknife Mines' RED-24 deposit. Although the gold recovery rate has not been publicized, it is known to be better than 90% compared to 65% using conventional milling.

In the Indin Lake area, NEPTUNE RESOURCES is spending about $7 million to conduct a test "vat leach" of low-grade rock from the Colomac Sill, a quartz-albite intrusion that includes one zone carrying 13 million tonnes of material grading 3 ppm gold (the test zone) as well as five other zones of comparable size and grade. Other major projects in the Indin Lake area are being carried out by joint ventures comprising ECHO BAY MINES LIMITED / PETROMET RESOURCES / COMAPLEX, and MAHOGANY RESOURCES / TREASURE ISLAND RESOURCES. The Echo Bay joint venture has outlined two significant deposits, the Main Zone and Cass Zone, hosted in mafic flows and a gabbro sill respectively.

In the Contwoyto Lake area, COMINCO recently obtained encouraging results from three holes drilled into iron formation on optioned ground about 30 km southeast of Lupin Mine. Each hole intersected 3 to 4 m grading 12 to 40 ppm gold.

In the Yellowknife area, TREMINCO RESOURCES is spending about $3 million to rehabilitate the old Ptarmigan Mine, a turbidite-hosted quartz-vein deposit with proven reserves of about 150 kt grading 10 to 11 ppm gold. Three other turbidite-hosted quartz-vein deposits in the sedimentary basin east of Yellowknife are in the underground exploration stage; The Kidney Pond Zone (GIANT BAY RESOURCES), the WT deposit (WESTFORT PETROLEUM) and the Lambert Vein (LIGHTNING MINERALS).

GIANT YELLOWKNIFE MINES LIMITED announced it will spend about $25 million at Yellowknife to construct a plant to re-treat 6.3 mt of tailings grading 2.3 ppm gold.

In the Russell Lake Basin, northwest of Yellowknife, newly discovered auriferous iron-formation units similar to Lupin are being evaluated by ABER RESOURCES, FREEPORT McMoRAN and others.

SUMMARY OF GEOLOGICAL WORK CONDUCTED BY THE NWT GEOLOGY DIVISION

Project Geologist Val Jackson continued long-term mapping projects, working in the Russell-Slemon Lake area (85 O/SE) during June and then moving north to continue mapping in the Kathawachaga Lake area (76 L/south) in July and August.

Other NWT Geology staff worked on turbidite-hosted gold-quartz veins (Brophy), mapping and showing evaluation in the Reid Lake area (85 I/11 and 12) (Seaton) and volcanic stratigraphy and geochronology of the Yellowknife volcanic belt (Padgham).

In addition, contracts were let to support university-sponsored projects, which are listed in Table 2 and described in a later section of this overview.

MINERAL DEVELOPMENT AGREEMENT

A Mineral Development Agreement was approved for the NWT. This program is under the umbrella of the general Economic Development Agreement (EDA). Total expenditures under the MDA over its life (1987 to 1991) are planned to be $7 million. The Geological Survey of Canada's MDA - Geoscience program will consume $2.85 million and the NWT Geoscience program will also expend $2.85 million. The remainder of the MDA funds, $1.3 million, will be spent assisting northern mining operators to improve their operating technology under the

TABLE 2: 1987 PROJECTS SUPPORTED BY MDA

PROJECT	UNIVERSITY/ PROFESSOR/ STUDENT	AMOUNT (thousands)
Detailed mapping and studies of gold-quartz veins in Granitoids northern Slave Province (mainly Anialik River area, NTS 76 M/11 and 14). This work will be co-ordinated with memoir preparation for the Hepburn Island area, 76 M (V. Jackson, et al).	University of Toronto/ Professor E.T.C. Spooner/ Student - Andy Abraham (Ph.D.)	$20
Study of Knight Bay type turbidite-hosted gold deposits (Gordon Lake area,NTS 85 I/14, 85 P/13). This work will be co-ordinated with detailed structural studies of the Slave Province (Fyson) and studies of turbidite-hosted quartz veins (Brophy).	Dalhousie University/ Professors Zentilli and Culshaw Student - Tim Stokes (Ph.D.)	$10
Study of Bugow type iron-formation gold deposits (Russell Lake area, NTS 85 O/4)and comparison to Lupin type deposits.	Carleton University/ Professor Richard Taylor/ Student - Dan Bunner (Ph.D.)	$10
Mapping of the Beniah Lake straight zone to determine its relationship to the evolution of the Beaulieu River supracrustal belt and its potential as a locus for gold mineralization. Geological maps of the supracrustal (mainly volcanic) belt will be generated. Work will be coordinated with MDA mapping (Carp Lake- Tundra area mapping project).	Ottawa University/ Professor Fyson/ Student - Dan Roach (Ph.D.)	$25
Studies of rare element pegmatitesof the NWT to map and characterize significant rare element pegmatites and produce reports on the mineralogy, petrology.	University of Manitoba/ Professor Cerny, Dr. Weiss (post Doc.) and various students	$20
Evaluation of the placer gold potential of the Nonacho Group (Proterozoic) clastic sediments.	Dr. L.B. Aspler	$10

Northern Technology Assistance Program (NTAP) ($1 million) and the Northern Mining Information Program (NMIP) ($0.3 million). Funds available (during 1987) for NWT operated programs are only $176,000.

Money was not available until late in the season, and the NWT portion of the field program was, as a result, rather small scale for the first year. It included six contracts to support mainly university-supervised field work as shown in Table 2.

Geological Survey of Canada programs planned for the MDA are listed in Table 3.

TABLE 3: GSC MDA PROJECTS

	PROJECT	COMMENCEMENT DATE
	Regional Geology	
1	Contwoyto-Nose Lake area	1987
2	Beaulieu River greenstone belt	1988
3	Tavani greenstone belts	1988
4	Mapping and geochemistry, Baker Lake	1987
5	Mystery Island Intrusive Suite	1987
6	Muskox Intrusion border zone	1987
7	Cameron River greenstone belt	1988
	Mineral Deposits	
1	Gold metallogeny, Slave Province	1987
2	Gold metallogeny, Churchill Province	1987
3	South Nahanni tungsten, rare metals	1987
4	PGE in ultramafic-mafic rocks	1987
5	Rare metals, Slave, Churchill, Bear Province	1987
6	Pine Point and Polaris mines	1987
7	Middle Proterozoic basins, alteration	1987
8	Metal-stressed vegetation	1988
	Exploration Geochemistry	
1	Gold and PGE in till, Churchill, Slave	1987
2	Gold, PGE and rare metals, Kaminak Lake	1987
3	Lake sediment geochemistry test	1988
	Exploration Geophysics	
1	Aeromagnetic gradiometer-VLF	1988
2	Integrated airborne geophysical surveys	1988

OPERATING MINES

C.E. Ellis
Staff Geologist

Eight mines were operating in the Northwest Territories at the beginning of 1987, but by mid-year this number was reduced to six (Figure 1). Mining ceased at Salmita Mines in mid-February and at Pine Point Mines at the end of June.

GOLD

NERCO-CON MINE began to reassess the older workings in the Campbell Shear zone to evaluate lower grade ore, some of which is refractory, and to assess the possibility of removing some crown and stope pillars with remote control equipment. Surface exploration concentrated on mapping structures followed by geochemical (soil and rock) analyses of these structures.

Production at **GIANT MINE** from underground zones ASD, GB and UBC contributed roughly 70% of the mill feed; production from C2 and A2 crown pits and B131 pit contributed roughly 30%. A ramp system from surface to the 1,200′ level will be completed by year end. A 100 tpd leach

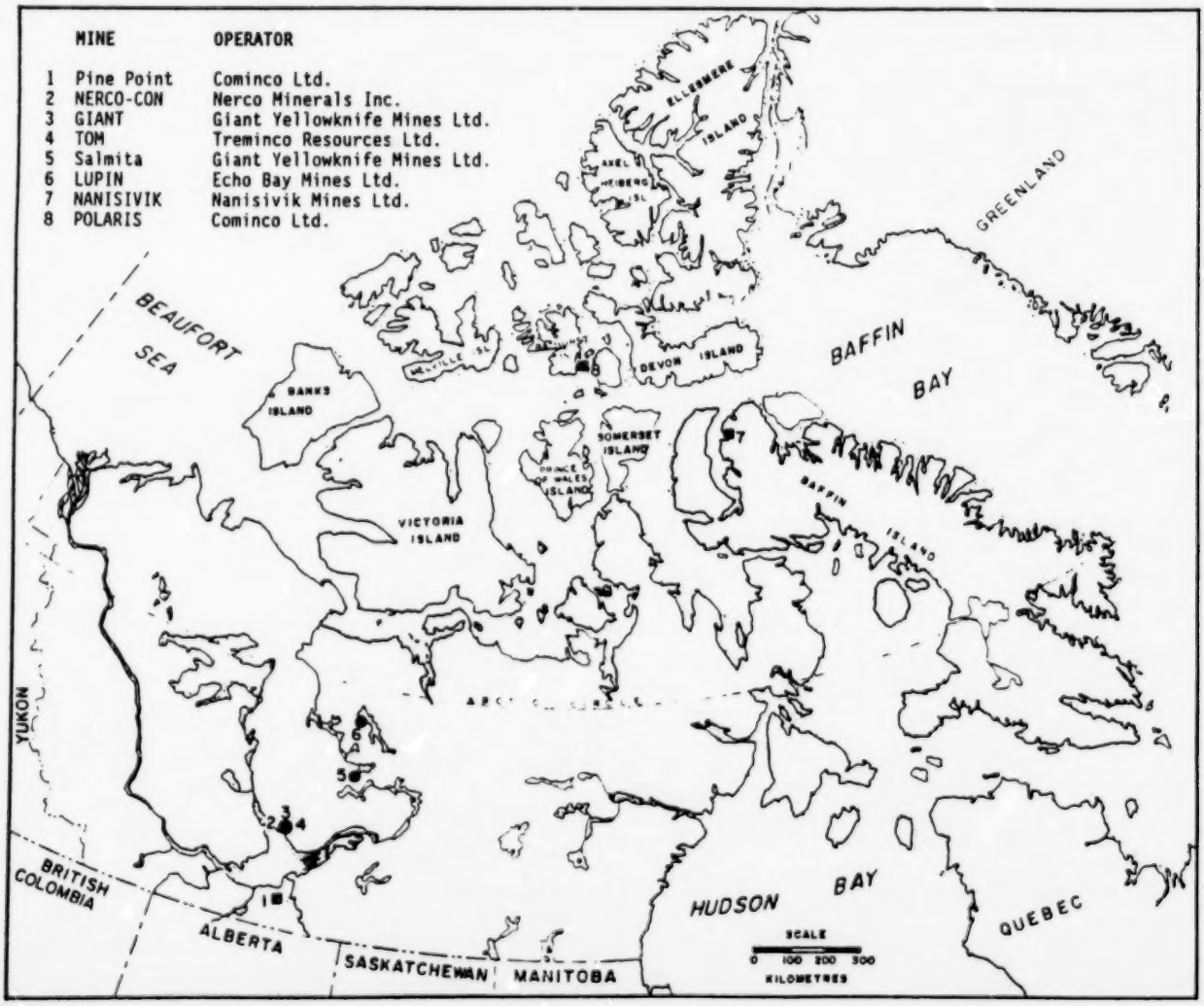

Figure 1: Mines operating in the Northwest Territories during 1987. A mine name in lower case indicate that the mine has closed.

TABLE 4: Production from mines operating in the Northwest Territories, 1987

Mine	Commodity	Ore Milled 1986	Production 1986	Reserves as of Dec. 31, 1986	Ore Milled*1 1987	Production*1 1987
Nerco-Con	Gold	198 kt*2	2,777 kg Au*2	?	340 kt	2570 kg Au 710 kg Ag
Giant	Gold	292.16 kt	1,993 kg Au	2,183 kg at 8.57 g/t	340 kt	2570 kg Au 710 kg Ag
Tom	Gold	10.9 kt	72 kg Au	?	?	?
Salmita	Gold	63.4 kt	1,528 kg Au	10.9 kt	22 kt at 25.7 g/t	568 kg Au 114 kg Ag
Lupin	Gold	560 kt	6,009 kg	2,770 kt Au 11.76 g/t	?	6060 kg Au3
Pine Point	Lead, zinc	2,967 kt	238.8 kt Zn 110 kt Pb	3,356 kt 9.6% Zn 3.5% Pb	3120 kt	295 kt Zn 126 kt Pb
Nanisivik	Lead, zinc silver	685 kt	60 kt Zn*1 3.7 kt Pb 25,372 kg Ag	2,818 kt*4 9.9% Zn 0.3% Pb 40 g/t Ag	?	?
Polaris	Lead, zinc	886 kt	114.4 kt Zn 25.1 kt Pb	18,143 kt 14.5% Zn 3.5% Pb	1011 kt	136 kt Zn 28 kt Pb

*1 *Estimate is based on production figures submitted to the GNWT Mines Inspection Service, except where indicated.*
*2 *Figures supplied by mine personnel.*
*3 *Estimate based on figures reported in Echo Bay Mines Ltd.'s first 3 quarterly reports for 1987.*
*4 *Reserves are as of January 31, 1987.*

circuit pilot plant operated for three months to recover gold from tailings.

Ore from Treminco Resources Ltd.'s **TOM MINE** was processed at the Giant Yellowknife Mines mill. A decline to the 250' level was completed in November. Treminco Resources Ltd. acquired the nearby Ptarmigan Mine from Cominco Ltd.

Mining ceased at **SALMITA MINE** in mid-February and the mine was allowed to flood at the end of March. Milling continued until the end of April. Giant Bay Resources treated roughly 330 t of ore in a bio-tankleaching pilot plant, which operated from May to mid-July. The addition of this circuit to the milling process increased gold recovery from refractory ore to over 95.6% from 65%. A 9.67 kg dore bar was produced.

A new hoist, capable of operating to 1,200 m, was installed in June at **LUPIN MINE** as part of the shaft deepening project. The cutoff grade was lowered to 10.5 g/t from 11.1 g/t early in the year. A tonnage increase to 1,727 t/day from 1,600 t/day has countered the mining of lower grade ore.

LEAD-ZINC

Mining ceased at **PINE POINT MINE** at the end of June. Milling will continue into 1988.

Drilling in the lower lens of **NANISIVIK MINE** was done to outline reserves.

Underground drilling at **POLARIS Mine** was done to define the reserves of the Polaris deposit.

ARCTIC ISLANDS REGION

Walter A. Gibbins
District Geologist

BASE METALS

In 1987, mineral exploration was directed towards the discovery and outlining of new ore reserves at the region's two producing Pb-Zn mines (Figure 2). At **COMINCO LTD.**'s Polaris Mine (1), surface drilling tested the mine area and an area south of the mine during the summer months. Underground drilling continued to outline the Polaris deposit in detail.

At the Nanisivik Mine (2) of **NANISIVIK MINES LTD.**, surface drilling was done to test geophysical anomalies on the west grid, the South Boundary zone west, the DEB east, Shale Hill and Oceanview areas. Underground drilling, mainly in the lower lens, continued to allow the transfer of probable resources to proven ore reserves.

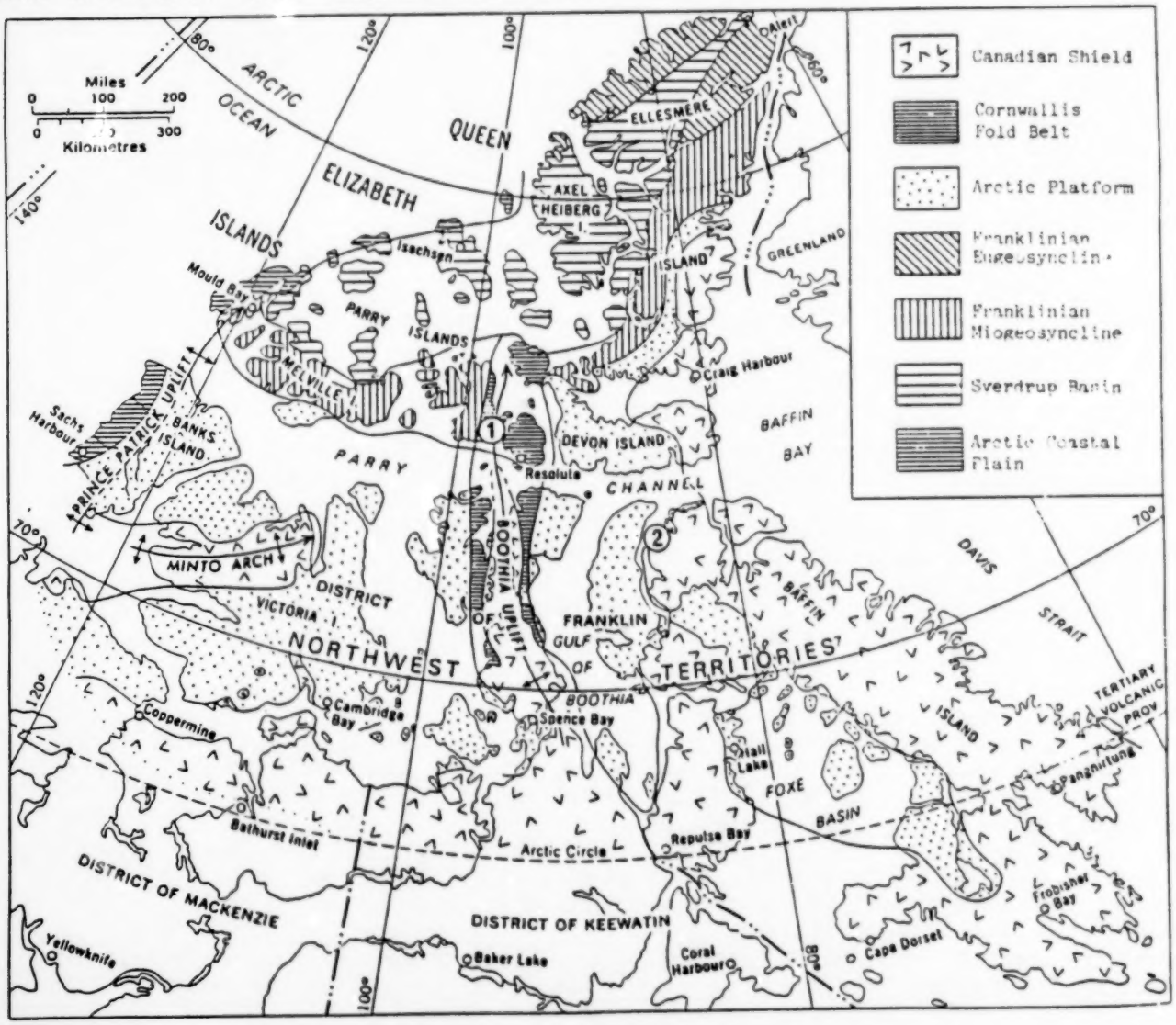

FIGURE 2: Mineral exploration in the Arctic Islands, 1987.

KEEWATIN DISTRICT

J.L. Griep
District Geologist

Properties explored in 1987 are shown in Figure 3.

GOLD

Gold continued to be the principal exploration target in the Keewatin, although exploration was confined to the Rankin-Ennadai Belt, the Yathkyed Lake area and several Archean belts in the vicinity of Baker Lake.

COMAPLEX RESOURCES INTERNATIONAL LTD. staked claims in the Rochon Lake area (21) west of Ennadai Lake. Several sulfide showings was prospected, mapped and sampled.

ABERMIN CORPORATION LTD. carried out trenching, mapping, geochemical and VLF-EM surveying on their SUNDOG (1) property, northeast of Cullaton Lake.

SUNMIST ENERGY '86 INC. conducted a program of airborne EM surveying (DIGHEM system), till sampling and mapping on the

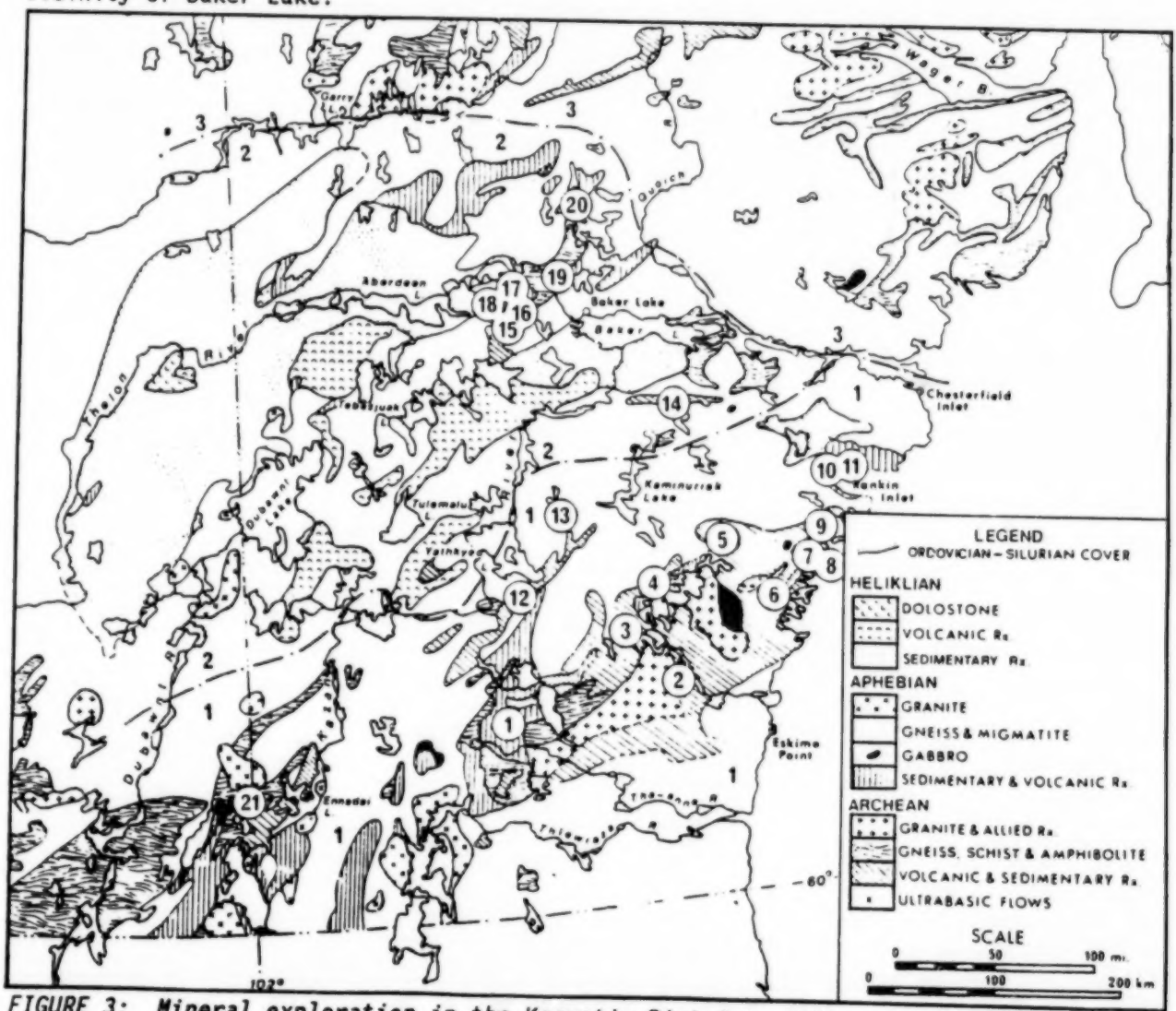

FIGURE 3: Mineral exploration in the Keewatin District, 1987.

SUNNY and MISTY claims (2) west of Maguse Lake. The Eric Lake gold prospect was tested by drilling.

DEJOUR MINES LTD., as operator for a joint-venture with **NOBLE PEAK RESOURCES LTD.**, carried out prospecting, mapping and sampling on the JOYCE and SPI claims (3) near Turquetil Lake.

NOBLE PEAK RESOURCES LTD. conducted diamond drilling, mapping and geochemistry, VLF-EM, magnetics and airborne EM (DIGHEM system) surveying on their HAPPY and NORM claims and prospecting permits optioned from **BOREALIS EXPLORATION** in the Happotiyik Lake area (5).

BOREALIS EXPLORATION LTD. conducted mapping, prospecting and sampling programs on prospecting permits in the Ferguson River (6) and Kaminak Lake (4) areas and on claims at Pistol Bay (9). The company drilled on the SUSAN claims near Fat Lake (6) before going underground to collect a 3,000 t bulk sample of quartz-vein material for metallurgical tests.

CANADIAN NICKEL CO. LTD. conducted mapping, sampling, magnetometer and VLF-EM surveys on its Igloo Project in the Wilson Bay area (7). Two gold showings were tested by diamond drilling.

FARAWAY GOLD MINES LTD. mapped and sampled around Whale Cove (8) on claims optioned from BOREALIS.

In the Yathkyed Lake area, **HOMESTAKE MINERAL DEVELOPMENT CO. LTD.** continued exploration of the SY claims (12) and adjoining prospecting permits. Mapping, sampling and geophysical surveys (magnetometer, VLF-EM) were carried out and several gold showings were drilled.

Joint-venture partners **ASAMERA MINERALS INC.** and **COMAPLEX RESOURCES INTERNATIONAL LTD.** participated in a number of properties in the Baker Lake area and conducted a program of mapping, sampling, prospecting and geophysical surveys on permits and claims at Parker Lake (14), Whitehills Lake (19) and the Meadowbank-Tehek Project area (20). Several areas were surveyed with the DIGHEM airborne EM system and diamond drilling was carried out on the MOON claims, south of Phoenix Lake (15).

GIANT YELLOWKNIFE MINES LTD. conducted mapping, sampling and airborne DIGHEM EM surveying of the SAM claims north of Phoenix Lake (16).

PLATINUM GROUP METALS (PGM)

Although exploration for PGM in the Keewatin has not yet attained a level comparable to that in other parts of Canada, it is anticipated that Beaverlodge-type of uranium mineralization, which is fairly widespread in the Yathkyed Lake area, will be examined for its PGM potential in view of recent discoveries in northern Saskatchewan.

The **ASAMERA/COMAPLEX** joint-venture carried out mapping, magnetic and Max-Min surveying on claims encompassing the abandoned North Rankin Nickel Mines workings (11) and have scheduled a drill program for late 1987.

BOREALIS EXPLORATION LTD. staked claims in the Rankin Inlet area (10), to explore for PGM with Cu-Ni sulfides associated with ultramafic and gabbroic sills.

HOMESTAKE MINERAL DEVELOPMENT CO. LTD. conducted mapping and sampling on claims and permits in the Ferguson Lake area (13) where INCO delineated a Cu-Ni deposit in the early 1950s.

URANIUM

Although uranium exploration activity is substantially below the unprecedented levels of the late 1970s, two companies remain active in the Thelon Basin, west of Baker Lake.

URANGESELLSCHAFT CANADA LTD. carried out diamond drilling to further delineate the mineralized lenses that comprise the Kiggavik deposit (formerly Lone Gull) (18). Total reserves are estimated at

18.3 kt of U_3O_8 at an overall grade of 0.6% U_3O_8, and a full-scale feasibility study to bring the property to the production stage, is expected to be commissioned shortly. On claims south of the deposit, resistivity lows defined by an airborne resistivity survey (DIGHEM-IV system) were followed up by gravity surveys, EM-16R surveys and diamond drilling. Mapping and geochemical surveys were also included in the field work.

PNC EXPLORATION CO. LTD. explored the F claims, optioned from **BP-SELCO LTD.** south of Schultz Lake (17) for unconformity-related uranium deposits. A number of potential drill targets resulted from gravity, EM-16R, magnetometer and VLF surveys, combined with geochemical and geological results.

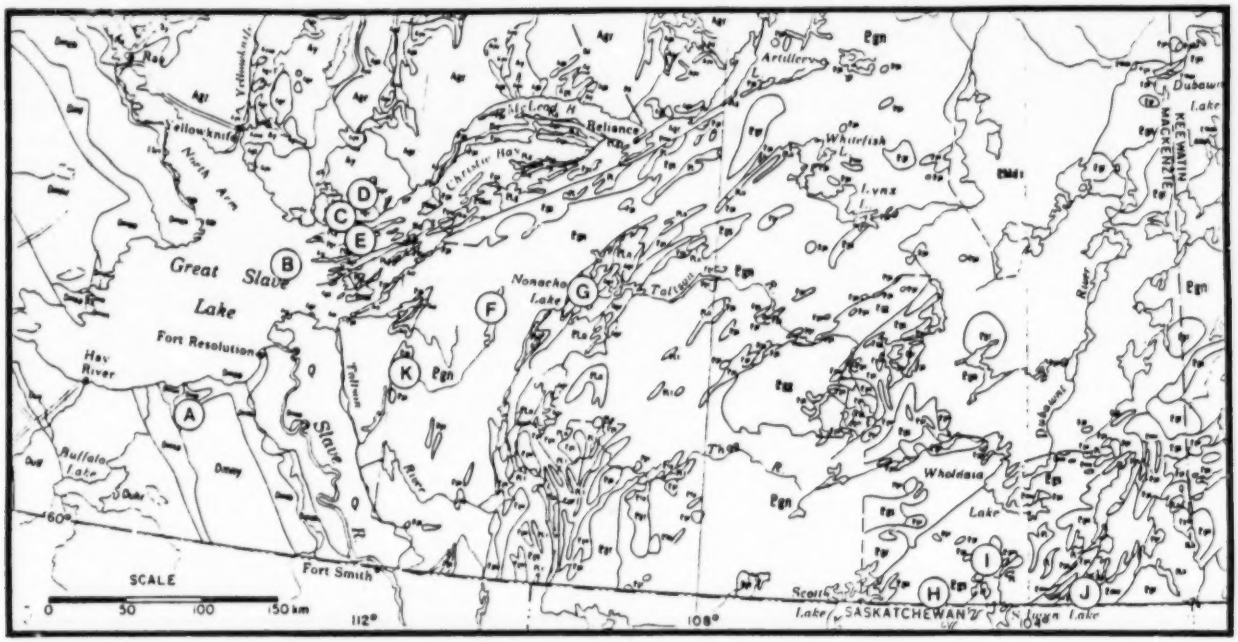

FIGURE 4: Mineral exploration in the Southeast Mackenzie, 1987. Geology from GSC map 30-1963.

EASTERN MACKENZIE REGION

Walter A. Gibbins
District Geologist

Properties explored in 1987 are shown in Figure 4.

LEAD-ZINC

PINE POINT MINES LTD. completed mining at Pine Point (A), however, considerable volumes of concentrate and higher-than-average grade ore remain in stockpiles. The 1987 exploration program cost about $2 million and consisted mainly of IP surveys and diamond drilling.

COBALT

HIGHWOOD RESOURCES LTD. planned to explore cobalt showings on Blanchet Island (E).

NICKEL-COPPER-PLATINUM GROUP ELEMENTS (PGEs)

In April, **TRIGG, WOOLLETT OLSON CONSULTING LTD.** managed a 1,400 m drill program on **ENEXCO INTERNATIONAL LTD.**'s Rutledge Lake claims (F). Surface showings of anomalous nickel, copper, platinum and/or gold and airborne EM conductors were tested at depth.

Prospectors **Anderson** and **Kizan** staked nickel-copper prospects with

platinum potential at Thoa Lake (I) and Opascal Lake (H), north of Stoney Rapids, Saskatchewan.

HIGHWOOD RESOURCES LTD. sampled olivine-rich norites of the Caribou Lake Gabbro, which forms the western margin of the Blatchford Lake Complex (C) for PGE potential.

BERYLLIUM AND RARE EARTH ELEMENTS

HIGHWOOD RESOURCES LTD./HECLA MINING LTD. continued feasibility and marketing studies of their Thor Lake beryllium deposit (D) in 1987. A mineralogical study of the niobium-tantalum-rich Lake zone was begun at the University of Alberta.

GOLD

It has been reported that **RAPPAREE RESOURCES LTD.** flew a DIGHEM airborne survey over their Outpost Island claims (B). The Outpost Islands are the site of the Fox Mine that produced 308 kg of gold, as well as copper and scheelite, in 1941-42.

J.S. Kermeen staked and prospected the ESK and ENN claims (J) near McLintock Lake (NTS 65 D/3,4). These adjoin other claims to the south in Saskatchewan.

OTHER

The DOG 1 claim, on the west shore of Nonacho Lake (G), was recorded in August, 1987. It covers metasediments of the Nonacho Group in a region of widespread uranium showings.

J.W. Price staked the RED 1 claim in the Rutledge River area (75 E/3) midway between Little Deskenatlata Lake and Conway Lake (K).

SLAVE STRUCTURAL PROVINCE

INTRODUCTION

Approximately $43 million was spent on exploration in the Slave Province in 1987, including about $10 million on development programs (Colomac and Ptarmigan projects) exclusive of operating mines. Gold was the principal exploration target, and only $200,000 was spent on the search for other commodities. Of the 84 projects, at least 49 involved diamond drilling or more extensive development such as open pit or underground development. Two projects, those of **NEPTUNE RESOURCES** (Colomac Project) in the Indin Lake area and **GETTY-NORANDA** (Tundra JV Project) in the Courageous Lake area, accounted for 38% of total expenditures for the Slave Province. Table 5 shows the distribution of expenditures amongst geological components of the Slave Province, and Figure 5 shows the location of the numbered projects discussed in the text.

TABLE 5: SLAVE PROVINCE EXPENDITURES

AREA	TOTAL PROJECTS	DRILL PROJECTS	EXPENDITURES (Millions)
Courageous Lake area	9	9	$12.80
Indin Lake area	6	3	$10.12
Yellowknife Supracrustal Basin	10	?	$ 6.71
Contwoyto Lake area	9	7	$ 2.77
Northeast Slave	9	7	$ 3.21
Russell-Slemon Lakes Area	11	5	$ 2.21
Yellowknife Volcanic Belt	7	4	$ 2.14
Other	19	5	$ 2.93
Reconnaissance	4	-	$ 0.19
TOTALS	84	49	$43.08

SOUTHERN SLAVE PROVINCE

John A. Brophy
District Geologist

YELLOWKNIFE SUPRACRUSTAL BASIN

ARDIC EXPLORATION LIMITED drilled and explored the Thompson-Lundmark property, a former gold producer (4).

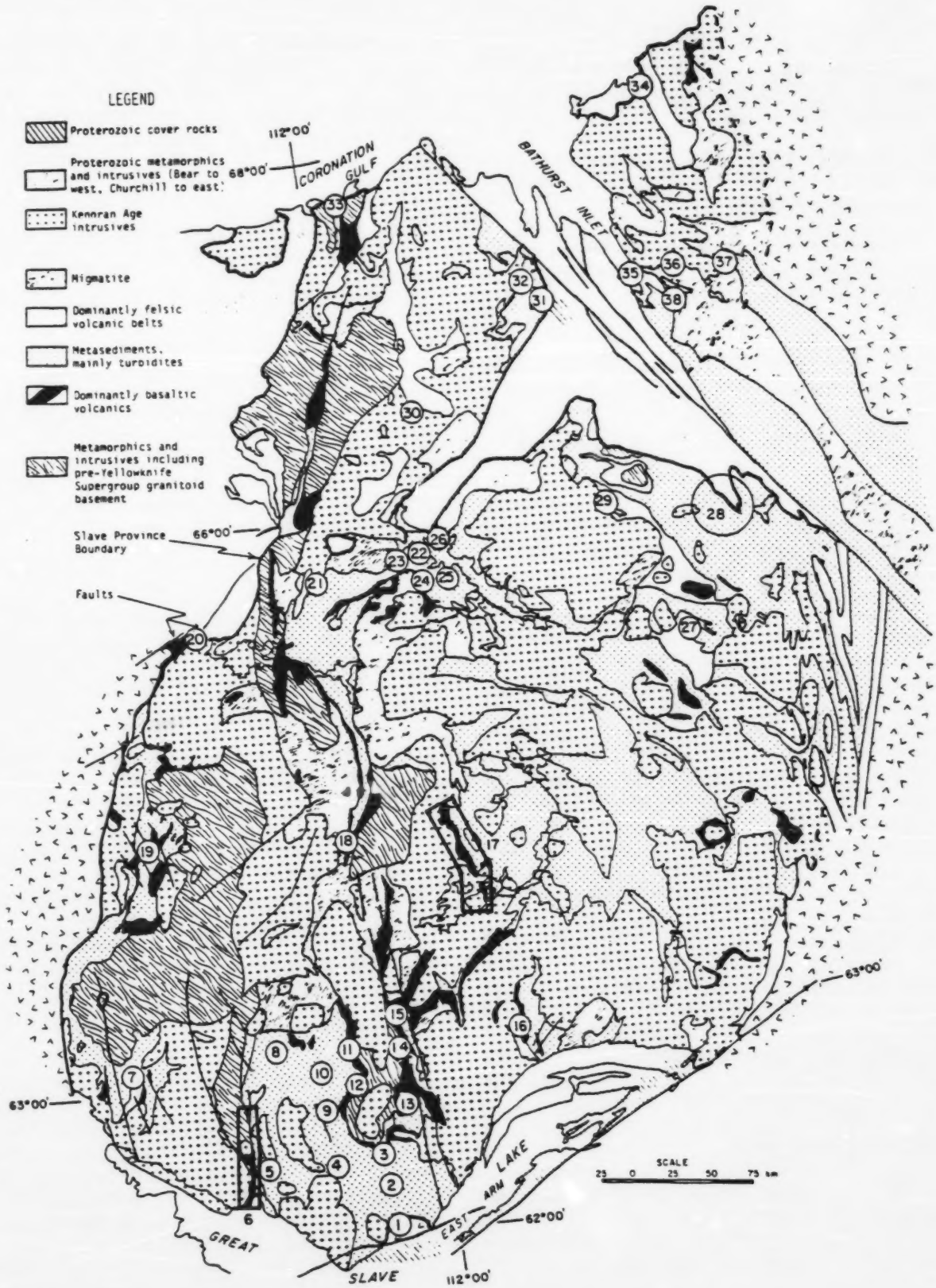

FIGURE 5: Mineral exploration in the Slave Province, 1987

BLACKRIDGE GOLD MINES-CRUISER MINERALS drilled 400 m on the DAF claims at Gordon Lake (10).

CANAMAX RESOURCES explored claims held in the vicinity of Discovery Mine, a former gold producer (8).

CANDORADO MINES conducted a small drill program on the GBI claims in the Gordon Lake area (10).

GIANT BAY RESOURCES explored their Knight Bay property on Gordon Lake (10) and continued underground development, bulk sampling and drilling of the Kidney Pond Zone. Several other zones were also drilled.

LIGHTNING MINERALS drove a decline into the Lambert Vein on the TT claims at Dome Lake (9) and extracted a bulk sample for metallurgical testing.

TREMINCO RESOURCES LIMITED, who operate the Tom Mine near Yellowknife, rehabilitated and developed the nearby Ptarmigan Mine (5), which was purchased from Cominco. Production from Ptarmigan is expected in the fourth quarter. Treminco also explored their land holdings in the Tom-Ptarmigan area and conducted a drill program on the GAB claims west of Gordon Lake (10).

VISCOUNT RESOURCES drilled a pegmatite body at Hidden Lake (4) to evaluate its lithium potential.

WESTFORT PETROLEUM and **CAMERON HOLDINGS** drilled several zones on the WT property at Myrt Lake (9). A decline into the main zone was rehabilitated. Airborne and ground geophysical surveys were carried out as well as detailed and reconnaissance geological mapping.

COURAGEOUS LAKE AREA

All of the nine projects in the Courageous Lake area (17) involved drilling, and eight projects were budgeted in excess of $400,000.

The largest project was that carried out by the **NORANDA-GETTY** joint venture on the Fat Zone (Tundra property), which comprises a number of gold-bearing shears cutting felsic volcaniclastic rocks. At the end of 1985, it was announced that shallow drilling outlined reserves in excess of 1 Mt grading 10 ppm gold to a depth of 120 m. Deeper drilling in 1987 confirmed the presence of ore-grade material at vertical depths of as much as 1,000 m.. The deposit is open at depth and along strike.

These encouraging results are partly responsible for the current level of activity in the Courageous Lake volcanic belt. Joint venture partners **BOW VALLEY INDUSTRIES** and **HEMISPHERE DEVELOPMENT** drilled along a 14 km segment of the belt adjoining the Tundra property and encountered significant gold anomalies in some holes.

Immediately south of the Tundra property, **GIANT YELLOWKNIFE MINES LTD.** drilled in the vicnity of the now defunct Salmita Mine and on other nearby properties. Further to the south, **BOW VALLEY INDUSTRIES** drilled on the BS claims acquired by option from **ROXWELL GOLD MINES**, and joint-venture partners **PARKLANE TECHNOLOGIES INC.** and **HIGHWOOD RESOURCES** drilled on the NOD claims.

To the north of the Tundra property, drill programs were carried out by **ABER RESOURCES** on the Jax property and by **COLRAY RESOURCES-CLAUDE RESOURCES** on the MIST and BULLY claims. **GUNNAR GOLD-MILL CITY GOLD** drilled on claims immediately west and north of the Tundra property.

INDIN LAKE AREA

The most cost-intensive program in the Indin Lake area was the Colomac Project (19) of **NEPTUNE RESOURCES**, who are testing the feasibility of open-pit mining and vat-leach processing of a large tonnage (12 t) lowgrade (3 ppm gold) deposit hosted in a quartz-veined albitite sill. Infrastructure for the test leach is completed, but the test itself will probably be delayed until next year.

ECHO BAY MINES LTD. completed two projects in the Indin Lake area on properties held in joint venture with **PETROMET** and **COMAPLEX**. Drilling on the KIM claims focused on the Cass Zone, where gold is in a quartz-veined gabbro sill. Geological, geophysical and geochemical surveying was carried out to the north of the KIM claims on the SPAN property (19).

At the north end of the Indin Lake volcanic belt, joint-venture partners **MAHOGANY RESOURCES** and **TREASURE ISLAND RESOURCES** conducted a drill program on the Spider Lake property (19).

Small projects in the Indin Lake area (19) were carried out by **TANQUERAY EXPLORATION** and **COMAPLEX RESOURCES**.

YELLOWKNIFE VOLCANIC BELT

In the Clan Lake area at the north end of the belt (6), **CANAMAX RESOURCES** drilled on the NOSE claims, **NORANDA** explored the BOSS claims, and **TROYMIN RESOURCES - CORONADO RESOURCES** drilled about 1,300 m on the MON and DIS claims. North of Yellowknife, **KELMET RESOURCES** did a small mapping and sampling program on claims near Walsh Lake (6).

In the Yellowknife area, **NERCO-CON MINES LTD.** conducted a small exploration program in the Con Mine area and also did some reconnaissance. **GIANT YELLOWKNIFE MINES LTD.** did at least 3,000 m of surface drilling on their leases (6). To the south of Yellowknife, **GOLDEN MARLIN RESOURCES** conducted drilling to test shear zones under the waters of Yellowknife Bay (6).

RUSSELL-SLEMON LAKES AREA

The Russell-Slemon Lakes area (7) has been one of considerable activity since **ABER RESOURCES** announced significant gold assays from drill core of amphibolitic, sulphidefacies iron formation on the BUGOW claims. The property was optioned by **FREEPORT McMORAN**, who completed additional exploration work and drilling.

ABER explored and drilled two other properties in the area this year, one at the north end of Russell Lake (SP claims) and another at Lajeunesse Bay. In addition, **ABER** explored claims in the Mosher Lake area, immediately east of Russell Lake.

CANAMAX also drilled a property at Mosher Lake which was optioned from **ROXWELL GOLD MINES**.

Other projects in the Russell-Slemon Lakes area were completed by **NORANDA**, **HEMISPHERE DEVELOPMENT**, **VISCOUNT RESOURCES**, **ASAMERA** (in joint venture with **KELMET RESOURCES**), **PROLIFIC PETROLEUM**, and several individual claim holders.

OTHER PROJECTS IN SOUTHERN SLAVE

UTAH MINES LTD. conducted geological mapping, geophysical and rock geochemical surveys on the COTTONGRASS claims in the Indian Mountain Lake area (16). Similar work, but including minor trenching and soil geochemical surveys, was completed on the LONGSPUR claims in the Fenton Lake area (11).

DOELCAM INC. flew airborne geophysical surveys over the WIN and TER claims (18) southeast of Winter Lake and conducted ground followup of anomalies.

TANQUERAY RESOURCES LTD. drilled 300 to 600 m on the AP-45 claim at Murphy Lake (12) in the Cameron River Volcanic Belt.

TERRA MINES LTD. completed 1,200 m of drilling on the WOLF claims at Spencer Lake (14) and demobilized the test-mining operations at Bullmoose (2).

HIGHWOOD RESOURCES-HEMISPHERE DEVELOPMENT and **NORANDA** explored their properties in the Beaulieu River Volcanic Belt at Sunset Lake (13). NORANDA also conducted a small program to explore properties staked for base-metal potential in the Weaver Lake area (3).

ECHO BAY MINES LTD. explored the RR claims at Redrock Lake (20) and conducted

reconnaissance surveys in the surrounding area.

GIANT YELLOWKNIFE MINES and jointventure partners **KELMET RESOURCES** and **ASAMERA** explored claims in the Indian Mountain Lake area at Brisbane Lake (16). **GIANT** also conducted a small exploration program on claims held at Bridge Lake (15). **GUNNAR GOLD-MILL CITY GOLD** explored properties in the Winter Lake area (18).

HIGHWOOD RESOURCES continued feasibility studies of the Thor Lake rare-element deposit (1).

ABER RESOURCES, CANAMAX, PROCAN and **NORANDA** carried out reconnaissance exploration programs in the Slave Province.

NORTHERN SLAVE PROVINCE

James B. Seaton
District Geologist

ASAMERA INC., in joint venture with **KELMET RESOURCES LTD.**, did geological reconnaissance and sampling in the Amoeba Lake area, near the Bathurst Norsemine property (20).

AURUN MINES drilled on the COM 1, 2 claim block near Contwoyto Lake (24).

BACK RIVER JOINT VENTURE conducted a large exploration program on the BRAU claims and several prospecting permits between the Western River and Beechey Lake (28). This area was served by two main camps at "George Lake" and "Boot Lake". The program included much diamond drilling.

BOW VALLEY INDUSTRIES LTD. drilled at several locations in the Contwoyto Lake area. Drilling locations included the BARB 1 (24), AU 7 (23), FIN claims (22) and PIXIE claims (23). Geophysical surveys were done on the BARB 1 and AU 5 claims. Work was done from a base camp at Fingers Lake.

CONSORT ENERGY LTD. in joint venture with **WESTERN CANADIAN MINING CORPORATION** drilled on the WEST claim (22) near Lupin Mine.

COMINCO LTD. in joint venture with **COGEMA LTEÉ** drilled a newly discovered gold deposit on the AU 23, 24 claim block, optioned from the Contwoyto Syndicate. Spectacular results were reported in 3 drill holes, which each penetrated several metres of sulphide-facies iron formation grading 12 to 40 ppm gold in one zone. The AU 23, 24 block (25) is roughly 25 km southeast of Lupin Mine.

South of the Hood River, **COMINCO** drilled on a property comprising the SGJV and VER claims and Prospecting Permit 1031 (30). A small amount of EM surveying was also done.

Near Contwoyto Lake, **ECHO BAY MINES LTD.** drilled in the Lupin Mine area (22) and on the CAR 9 claim at Concession Lake (23).

ECHO BAY MINES drilled on the DOUGHALL claim in the Wilberforce Basin (37).

Near Itchen Lake (21), **ECHO BAY MINES** drilled on the CUB 1 and RUSH 5 claims. Follow up work on targets established by a DIGHEM airborne survey of the Contwoyto Lake-Itchen Lake-Point Lake belt of metasediments was conducted out of Echo Bay's Leanne Lake camp about 30 km east of Itchen Lake.

GIANT YELLOWKNIFE MINES LTD. drilled on the JOYCE, TANIA, PATRICIA claim block, which extends across Contwoyto Lake from the northeastern side of the Lupin Mine area.

HECLA MINING COMPANY OF CANADA LTD. explored the JOHN, SHIN and DLER claim block which lies mainly on the northeastern side of Contwoyto Lake (22,26). Work included diamond drilling.

OROFINO RESOURCES LTD. performed surface exploration and a small amount of diamond drilling on the CANUC RESOURCES LTD. property south of Arcadia Bay (33), Coronation Gulf.

SILVER HART MINES LTD. program in the Wilberforce Basin area included drilling on the Farney and G zones on the FARN, KNUT claims property (31), and trenching and drilling at Turner Lake (TURNER, TURN claims) (32). A magnetometer survey was done over the KNUT and WOLF 6 claims.

SIRIUS ENERGY CORPORATION drilled on the FIRE claims near Regan and Fiddler Lakes (27). Three of the six holes drilled were north of Regan Lake and three south of Fiddler Lake.

PARKLANE TECHNOLOGIES LTD., in joint venture with **HIGHWOOD RESOURCES LTD.**, conducted EM and IP surveys and sampled soil on the ROX and VOX claims, south of Shallow Bay, Contwoyto Lake (25).

UTAH MINES LTD. surveyed the TROY claims (23) near the north end of Contwoyto Lake by magnetometer, VLF EM and geological mapping and by diamond drilling. About 25 km to the south-southwest, the RISK claims were explored during a one-day sampling traverse.

In the Regan Lake area (27), **UTAH MINES LTD.** explored ROYAL 1-3 claims. Between Itchen Lake and Point Lake, roughly 20 km south-southwesterly of Itchen Lake, **UTAH MINES LTD.** explored the MIRAGE 1-3 claims.

NORTHEAST OF BATHURST INLET

Walter A. Gibbins
District Geologist

HOPE BAY VOLCANIC BELT

ABERMIN CORP. prospected and trenched contacts and shear zones of the Hope Bay Volcanic Belt (34).

HIUKITAK RIVER AREA

SILVER HART MINES LTD. tested an amphibolite horizon that extends under Kathleen Lake (35) with 1,800 m of drilling. The claims, known as the Warner Property, are held under option from **BEAR CREEK HILLS ESTATES LTD.**

ECHO BAY MINES LTD. drilled amphibolite horizons on the NEST claims, 15 km south of Gambit Lake (38) (3 holes - 210 m), the BEAR 2, 3 claims east of Gordon Bay and south of the Hiukitak River (36) (7 holes - 460 m) and the adjacent BC 1 and 2 claims optioned from **BEAR CREEK HILLS ESTATES LTD.** (2 holes - 145 m).

CHEVRON MINERALS LTD./GALVESTON RESOURCES LTD. mapped, trenched, prospected and flew an airborne EM survey over the LB claims, 25 km east of the head of Gordon Bay (37), to establish potential drill targets. Assays were reported as high as 44.57 g/t Au over 1.5 m. Prospectors **Anderson** and **Kizan** prospected and staked additional claims in the adjacent area.

BEAR CREEK HILLS ESTATES LTD. was also active in the Hiukitak River area and staked more claims in 1987.

BEAR PROVINCE

James B. Seaton
District Geologist

Properties explored in 1987 are shown in Figure 6.

EQUINOX RESOURCES LTD. work included diamond drilling at the Muskox Intrusion of targets on the VAL and SPEE claims (1). The target was platinum group metals.

CEGB EXPLORATION CANADA LTD. explored for uranium in the Longtom and Zebulon Lakes area (Prospecting Permits 1098, 1099) and Hottah Lake area (2). They also reconnoitred the Lindsay Bay area and performed mapping and surveys in the Echo Bay, Contact Lake and McLeod Lake area (3) on the CROSS, BULLY and BULLWINKLE claims.

CORDILLERAN DISTRICT

John A. Brophy
District Geologist

Total exploration expenditures in the NWT Cordillera amounted to about $300,000. Properties explored in 1987 are shown in Figure 7.

GIANT YELLOWKNIFE MINES LIMITED drilled gold showings on the GRUMP claims.

EQUINOX RESOURCES explored for sphalerite deposits enriched in gallium and germanium on claims near Wrigley (3) and on their prospecting permit covering NTS 95 M/7 (2).

Nineteen claims were staked by individual prospectors in NTS areas 95 D/15, 95 E/7 and 95 B/6.

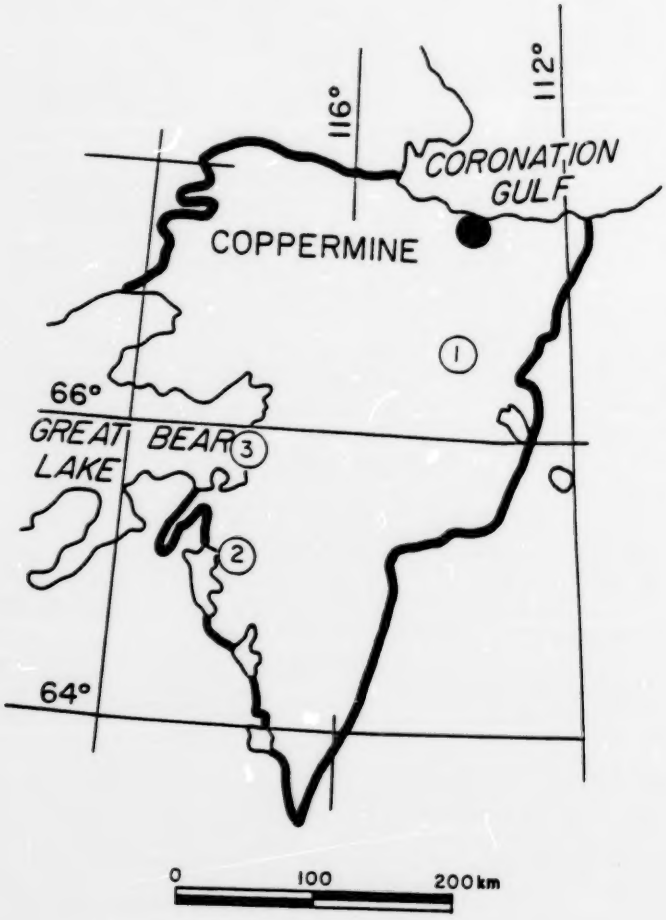

FIGURE 6: Mineral exploration in the Bear Province, 1987.

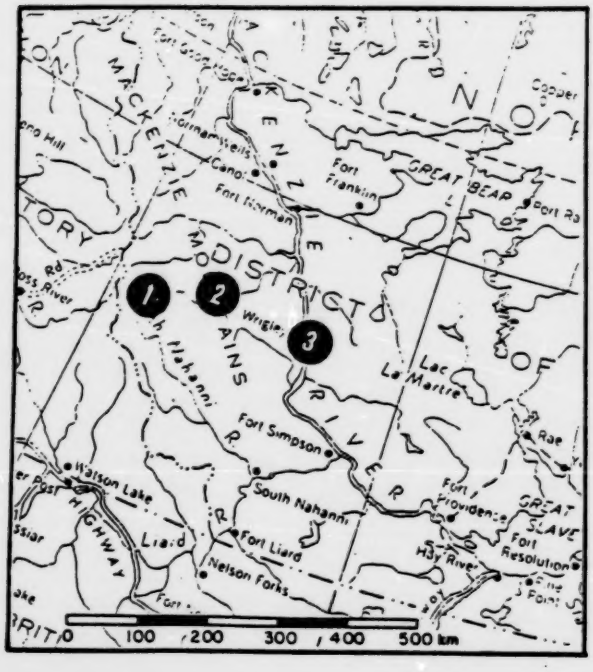

FIGURE 7: Mineral exploration in the Cordillera, 1987.

SUMMARY OF DRILLING - 1987

and Comparison with 1985 & 1986 Drilling
All figures in metres

	1985	1986	1987*
BY DISTRICT			
Franklin (Arctic Islands)	31,670.5	33,866.5	23,815.0
Keewatin	17,334.5	20,622.8	32,867.6
Mackenzie	112,934.7	108,322.6	102,779.0
BY GEOLOGICAL PROVINCE			
Slave	97,875.0	78,047.9	97,975.5
Bear	-	1,155.0	3,169.2
Churchill	42,215.5	46,904.3	44,639.52
Cordilleran	8,323.8	-	244.5
Interior Platforms	685.8	26,660.2	-
Innuitian	12,839.5	10,044.5	13,433.0
BY COMMODITY			
Uranium	17,325.6	13,443.7	8,664.1
Base Metals	32,087.8	60,526.7	23,815.0
Precious Metals	102,029.8	85,226.9	122,423.5
Tungsten and Rare Metals	10,496.5	1,325.6	-
Platinum Group Elements	-	2,288.9	4,559.1
TOTAL DRILLING	161,939.7	162,811.9	159,461.7
Surface	97,252.6	119,961.5	119,425.3
Underground	64,687.1	42,850.4	40,036.4

* Data as of November 26, 1987

MUSKOX INTRUSION MARGINAL ZONE DEPOSITS HOSTING PGE'S AND GOLD

D.J. Atkinson, U. of Western Ontario,
J.W. Page, Beaty Geological Ltd.

The Muskox intrusion, a classic Proterozoic layered mafic-ultramafic complex, is in the Coppermine River area approximately 500 km north of Yellowknife. The intrusion consists of four sections: a feeder dike, a central layered series, an upper border zone, and marginal zones.

The marginal zones are layers 60 to 350 m thick paralleling the inward dipping contacts of the funnel shaped intrusion cutting country rock metasediments and gneisses. Copper-nickel-bearing sulphide minerals concentrated along the margins host platinum, palladium and gold. Recently reported results from reconnaissance drilling on the eastern margin by Equinox Resources include intersections of 41.14 g/t and 58.29 g/t combined platinum/palladium and 5.83 g/t and 5.14 g/t gold respectively.

Chalcopyrite-pyrrhotite and minor pentlandite form massive layers 3 to 4 m thick, breccia zones, disaggregations, pods and fine disseminations. Magmatic seggregations, immiscible melts, sulphide-silicate replacements, and later remobilization of chalcopyrite document some of the more obvious textures in the mineralized sections.

Samples from the Muskox Reef contain anomalous concentrations of platinum and palladium. There appears to be an association with chalcopyrite, whereas chromite-bearing samples generally returned low assays.

Core specimens and polished thin sections detail host and country rock mineralogy and textures. A hornfelsed zone up to 10 m wide, considered important. We progress through serpentinized and brecciated peridotites, quenched and hornfelsed gabbroids, hornfelsed country rocks and fluidized granophyres. We emphasize mineralized sections and report on the recent October drill program.

REPORT ON PRELIMINARY MAPPING AND GEOCHEMISTRY OF THE WESTERN PLUTONIC COMPLEX

D.J. Atkinson
University of Western Ontario

The Western Plutonic Complex is a composite batholith consisting of six major granitoid phases and forms the western boundary of the Yellowknife greenstone belt. A traverse across the complex is useful in observing the textural and chemical variation within the batholith and its relationship to the bordering greenstones.

Spectacular examples of intrusive brecciation, assimilation, hybridization, and potassic alteration occur locally along the granite-greenstone contact and sporadically within the batholith. Landsat imagery detects some of the most evolved phases of the Western granodiorite in which there are conjugate molybdenum-bearing quartz veins and gold-bearing shear zones. Multiple sets of deformed mafic dikes throughout the batholith may have fed a Yellowknife type volcanic system implying a much more extensive greenstone belt than the current rift basin margin model configuration suggests. Intensive volcanic-sediment contamination throughout the batholith supports such an extensive supracrustal terrain. Metavolcanic and metasediment screen zones within the intrusion may aid in outlining plutonic

lobes in the undivided batholith. Volcanic exposures observed on islands along the North Arm of Great Slave Lake may represent extensions of the Yellowknife greenstone belt. Swarms of cognate enclaves may provide clues to source material while individual xenoliths act as windows into the granitoids emphasizing regional deformation not easily identified in the host rocks.

Samples collected from six granitic bodies are grouped into two suites for geochemical comparisons. The WSA suite, a sodic to potassic series, includes samples from the Western granodiorite, the Southeastern granodiorite and the Anton Complex. Modal compositions range from diorite through to granite. The ADS suite, a more strongly evolved potassic series comprises the Awry, Duckfish and Stagg granites with minor tonalite and granodiorite. WSA rocks are metaluminous to peraluminous with chemical and mineralogical characteristics of I-type granites. ADS rocks are peraluminous to rarely peralkaline and metaluminous, mineralogically I-type granites and plot in both I and S-type fields.

Various xy plots and ternary projections aid in isolating various phases and differentiation trends within the batholith.

PRELIMINARY REPORT ON ZONES OF EARLY PROTEROZOIC DUCTILE SHEAR ASSOCIATED WITH NORTHERN TALTSON MAGMATIC ZONE

H.H. Bostock
Geological Survey of Canada

Along the eastern exposed margin of Churchill Province south of Great Slave Lake Shear Zone, granitic plutonism of Taltson Magmatic Zone extends southward into Alberta. East of the northern part of this magmatic zone, retrograded meta-diorite, mafic and granitic gneisses and amphibolite of inferred Archean age are overlain by fine to coarse clastics of the Nonacho Group of probable early Proterozoic age. Within the zone two batholithic plutons comprising the Slave Monzogranite (1955 Ma), the Knoth Syenogranite (1922 Ma) and a minor charnockite pluton intrude granulite facies gneisses likely of Archean age. Granodiorite, diabase, quartz latite and feldspathic dykes with associated fluorite intrude these rocks.

Zones of early Proterozoic ductile shear associated with Taltson Magmatic Zone have developed extensive mylonite belts in quartzo-feldspathic rocks and a major belt of low-grade slate and schist in gneisses of sedimentary-volcanic origin. Cataclasites are prominent locally. These zones provide a complex pattern of sinistral and dextral shear, which may contribute to a better understanding of early Proterozoic regional plate tectonics if the sequence and absolute age of the various shears can be determined.

GEOLOGY OF THE LUPIN GOLD DEPOSIT, CONTWOYTO LAKE, NWT

Ralph Bullis
Echo Bay Mines Ltd.

The Lupin deposit is hosted by amphibolitic iron formations which are within a greywacke turbidite sequence of Yellowknife Supergroup rocks. These sediments are described by L.P. Tremblay (1976) as belonging to the Contwoyto Formation within Yellowknife Supergroup stratigraphy.

Four mineralized zones have been identified to date at Lupin: the West Zone, Centre Zone, East Zone and L-19 Zone. The West, Centre and East Zones are within near-vertical limbs of steeply plunging folds and are connected by fold noses. Together, the West, Centre and East Zones make up a total strike length of approximately 1,000 m along which the amphibolitic iron formation are gold and sulphide-bearing. The West and Centre Zones are known to contain gold and sulphide minerals from surface to a depth of 650 m. Both the West and Centre Zones

are open to depth and the West Zone is open along strike.

The mineralized zones are characterized by the presence of sulphides, gold, quartz veining and an alteration of the amphibole grunerite to hornblende. The predominant sulphide is pyrrhotite with arsenopyrite, loellingite, minor pyrite and chalcopyrite also present. In the main ore zones, sulphide content can be as high as 30%, while at the edges of ore zones or in low-grade areas, sulphide content can decrease to less than 5%. Sulphide banding in ore mimics bedding planes in places other than main ore zones.

CHARACTERISTICS OF AURIFEROUS IRON FORMATIONS IN THE RUSSELL LAKE REGION

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Carleton University

During the summer of 1987, the focus of Aber Resources' exploration in the southern Slave Structural Province was the northern half of the Russell Lake region. The area that was prospected in detail is bordered by Lajeunesse Bay in the south, Slemon Lake in the west, Gagoo Lake to the north and the Wecho River in the east. Three recently discovered showings, on the Bugow and S.P. properties, bring the total number of significant gold showings in the Russell Lake region to six.

Each of the gold showings is hosted in Archean rocks of the Yellowknife Supergroup. Mineralization in five zones is closely associated with isoclinally folded silicate-sulphide facies iron formation, interbedded with garnetiferous chlorite schists, psammatic and pelitic meta-greywackes, cordierite-bearing muscovite schists and/or meta-turbidites. However, ore-grade gold assays were also obtained from shear-zone controlled quartz-pyrite-arsenopyrite veins hosted by the meta-turbidites, silicic meta-greywackes and andalusite schists. Proterozoic faults, containing chloritized quartz-pyrite stockworks with trace chalcopyrite, cross-cut all lithologies except diabase and also contain anomalous gold concentrations (Lord, 1942).

Of the six significant gold showings, four of the iron-formation type are located above the lower amphibolite-cordierite isograd. These are known as the Andrew and Cabin Lake zones of the Bugow property (best recorded drill intersection is 15.09 g/t over 12.10 m) and the Main and North Zones of the S.P. property (best recorded drill hole assay is 20.57 g/t over 1.31 m). The auriferous Wecho River iron formations are hosted by greenschist facies rocks as are the gold-bearing quartz veins found near the southern outlet of the Snare River. Highly anomalous gold concentrations have also been recorded in iron formations hosted by high-grade metamorphic gneisses on the S.P. property. Background gold concentrations were found to be higher above the lower amphibolite-cordierite isograd, and the volume extent of gold present in rocks approaching high grade is much less than those just above the change in metamorphic grade. These factors favour exploration in areas on the high side of the isograd; however, evaluation of the Wecho River showing is in a preliminary stage and thus the conclusions are tentative. Gold concentrations range from 0.01 to 32.0 g/t over a strike length of 3 km, but tonnage estimates are not available.

There are textural and mineralogical differences between gold-bearing iron formations that are above and below the isograd. Auriferous greenschist facies iron formations can be distinguished from those of lower amphibolite-cordierite grade by:

(1) an increase in grain size; (2) an increase in chlorite and biotite content; (3) a higher degree of preservation of primary sedimentary structures; (4) a tendency to be schistose rather than hornfelsic; (5) a decrease in the silicic nature of the iron formation as reflected by its colour, hardness and density; and

(6) a tendency to contain pyrite rather than pyrrhotite as the dominant sulphide mineral.

Characteristics of both types of iron formation include:

(1)similar whole-rock major and trace element geochemistry; (2) a lack of oxide iron minerals, other than in cross-cutting fractures and veinlets or in areas of intense deformation; (3) pyrrhotite forming the dominant sulphide mineral with common retrograde transformations to pyrite (this is especially relevant on the Bugow property); (4) a lack of substantial arsenopyrite; (5) a lack of correlation between gold distribution and quartz veins; (6) isoclinal folding of all of the iron formations with gold being found in both the limbs and the fold noses, but with no evidence of upgrading of gold concentrations in the nose areas; (7) a ubiquitous alteration of grunerite to hornblende and thuringite, coupled with a corresponding decrease in stilpnomelane and an increase in biotite; and (8) a strong spatial association of gold mineralization with iron formation which contains ovoid to rod-shaped recrystallized quartz masses.

Detailed whole-rock major and trace element studies of auriferous iron formation within the lower amphibolite-cordierite facies have been undertaken to identify (1) possible pathfinder elements for gold mineralization and (2) chemical alteration patterns. Only minor additions of whole-rock major or trace elements could be delineated by BMDP statistical analysis or by the Grant (1986) methods of alteration analysis; therefore changes of the iron-formation mineralogy are interpreted as having occurred isochemically during metamorphism. Trends observed with increasing gold tenor are as follows:

(1) arsenic decreases strongly; (2) antimony decreases strongly; (3) total sulphur increases strongly; (4) structural water increases; (5) copper increases; (6) TiO_2 increases weakly; and (7) P_2O_5 decreases weakly.

In addition, L.O.I. values were determined to be three times higher in drill-core samples with significant gold assays than in those with poor assay results; and samples with gold concentrations greater than 6.86 g/t consistently have Au/Ag ratios between 3:1 and 5:1, whereas Au/Ag ratios do not exceed 3:1 for those samples with gold assays of less than 6.86 g/t.

All of the above findings have been corroborated by detailed investigations of field and petrographic relationships. Similar results have been produced by various researchers for the Contwoyto Lake and Point Lake areas of the Slave Province (C. Ford, pers. comm.; 1986; J. Kerswill, pers. comm., 1987). Continued geochemical analysis and the addition of new samples to the statistical data-base are ongoing with a view to providing an exploration model that is applicable to the search for gold mineralized iron formations in the Slave Province.

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GEOCHEMICAL EXPLORATION IN GLACIATED TERRAIN: GEOCHEMICAL RESPONSES

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Mineral exploration in regions that were glaciated during the Quaternary is hampered by the scarcity of outcrops and by the variable thicknesses of allochthonous glacial drift that mantle the bedrock. Geochemical strategies that have been successful in exploration usually involve an understanding of the history of the glaciated landscape.

The past decade has seen a substantial increase in our knowledge of

glacial stratigraphy and associated ice flow directions. In many areas of thick drift, the glacial succession has been found to contain multiple tills having different provenances related to distinct ice flow directions. Drilling and trenching have been instrumental in providing data on the glacial succession. Of particular value has been the ability of the sonic drill to recover intact core of the entire glacial sediment sequence. Light portable drills have been used similarly in areas of thin drift. The increased use of till geochemistry in mineral exploration and regional surveys has resulted in documentation of many dispersal trains derived from mineraled zones and from distinctive bedrock units.

Stratigraphic drilling programs and major reconnaissance surveys of till geochemistry have provided baseline data for other geochemical data sets, mineral exploration, bedrock mapping and environmental studies. Data on surficial geology, glacial stratigraphy and ice flow directions have been collected to aid interpretation of the till geochemistry. Research on the residence sites of metals in till has indicated that specific grain size ranges and mineralogical forms hold the bulk of the metals, depending on the species of primary metal-bearing mineral and the history of glacial comminution and weathering.

METALLIC OCCURRENCES AND OPPORTUNITIES IN ALBERTA

Dixon Edwards
Alberta Research Council

Metallic mineral potential exists in all of the major areas of Alberta's interior platform: the Phanerozoic rocks of the plains (gold, iron ore, lead-zinc), the Athabasca basin (uranium, lead-zinc), and the exposed and shallowly buried Precambrian Shield (sulphides, uranium).

On the plains, placer gold mining began as early as 1887 and is still proceeding. Current gold recovery is largely from paleoplacers. More study is needed to define the greatest concentrations, source and transport history of the gold. The Clear Hills iron deposit (oolithic geothite) contains 160 Mt of proven strippable ore. Beneficiation problems have been overcome so that development could proceed when the economic conditions improve. Lead-zinc deposition, similar to Pine Point, 100 km north of the Alberta border, may occur in Alberta. Petroleum data (core and logs) are evaluated as a tool for lead-zinc exploration. Some geologically interesting situations in the plains area include the Peace River Arch, Steen River structure and the Sweetgrass Arch.

Uranium-bearing minerals probably are in the Alberta portion of the Athabasca basin. Such mineralization may be of the Cluff Lake type and, as such, rock associations and geological structures may be exploration targets as well as graphitic conductors.

The exposed Shield and adjacent area of shallow Phanerozoic cover (83,000 km^2) has numerous sulphide and uranium mineral showings and at least one drill-hole with significant gold concentrations.

SATELLITE REMOTE SENSING FOR GEOLOGISTS

H. Epp
Canada Centre for Remote Sensing

Satellite remote sensing is a valuable tool for the interpretation of geological information required for mineral exploration in Canada. Satellite images can provide details on regional geology and on local structure, lithology, physiography, overburden and vegetation.

In a number of regions of Canada, basement rock is covered by glacial till, relatively dense vegetation and diverse terrain. Surveys carried out are therefore largely based on morphology and patterns, as well as linear forms

appearing in the vegetation or topography. The broad view and low cost of satellite data are ideally suited to wide-area mapping of geological features.

An overview of the satellites, sensors and data types available will act as an introduction to visual and digital analysis of satellite imagery. Examples of projects carried out, using satellite data in combination with conventional photointerpretation techniques, will also be presented.

CLASTIC DYKES IN ARCHEAN PILLOWED VOLCANIC ROCKS OF THE GIANT SECTION, YELLOWKNIFE, NWT: THEIR SETTING, STRUCTURE, INTERPRETATION AND SIGNIFICANCE

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Studies of Archean rocks are often plagued by a scarcity of outcrop. However, the "Giant Section" near Yellowknife, has large areas of nearly continuous exposure of the Yellowknife Bay Formation. This member of the Upper Kam Group is part of a thick homoclinal succession of mafic and felsic volcanic, volcaniclastic and intrusive rocks plus intercalated sediments, all metamorphosed to greenschist facies. There has been little deformation and many primary structures and fabrics are well preserved.

Among the unique features at the Giant Section are seven clastic dykes, up to 20 m in length and 50 cm in width, cutting perpendicularly across a non-variolithic pillowed lava flow. The dykes are infilled by a well-sorted lithic sandstone, varying in grain size from coarse to fine sand, as well as fragments of pillows and pillow selvages. Lamellae within the dykes are sub-parallel to the strike of the local bedding, indicating a passive infilling of fractures prior to deformation of the volcanic belt. The source of the sand in the dykes has been identified as a sandstone bed that overlies the pillowed flow for three reasons: 1) At two separate localities, dykes coalesce with the upper sandstone. 2) All dykes wedge-out before reaching the lower sandstone bed. 3) The dyke infill is compositionally and texturally different from the lower sandstone but, similar to the upper sandstone.

Although the dykes are most commonly between pillow selvages, they also cross-cut some pillows without causing chilled margins, and infill radial cooling fractures. This suggests that the dykes were formed soon after solidification of the pillowed flow and prior to lithification of the sandstone bed.

Formation of dyke fractures resulted from shallow-level gabbro sill intrusion, which caused a gentle up-doming of the overlying interbedded flow and sediments. As the flow cracked due to the differential uplift, loose sand filled the fractures. Thus, the clastic dykes support synvolcanic emplacement of many of the gabbroic intrusions at the Giant Section, and perhaps, by analogy in other parts of the Yellowknife volcanic belt. The gabbros in the Yellowknife volcanic belt are not economically significant, but similar gabbros at the Cass/Kim Claims, near Itchen Lake, are gold bearing. Understanding the timing of gabbro emplacement may aid in the search for gold in the Yellowknife shear-zones.

AN OVERVIEW OF SELECTED GOLD PROSPECTS WITHIN EASTERN BATHURST INLET AREA, NWT

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The Bathurst Inlet area is approximately 550 km northeast of Yellowknife at the northeastern corner of the Slave Structural Province.

Echo Bay Mines has been exploring the Bathurst Inlet region, particularly the eastern margin, for gold-bearing Archean iron formation each field season since August, 1984.

Peter Thompson of the Geological Survey of Canada in mapping the Tinney Hills and west half of Overby Lake map sheets has outlined Yellowknife Supergroup metasediments having lower greenschist to granulate facies metamorphism.

Prospecting by Echo Bay has shown deformation within gold-bearing iron formation reflects the regional geology, and has shown gold is in two belts of weakly to highly deformed Archean rocks up to 40 km in length.

DEFORMATION OF METASEDIMENTS NEAR GRANODIORITE PLUTONS, JACKFISH ISLANDS AREA, YELLOWKNIFE BAY

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Successive folds, cleavages and quartz veins in metasediments, Jackfish Islands area, vary in orientation and style, recording an increase in strain towards migmatitic margins of granodioritic plutons. Large-scale early F_1 folds trending westerly along the eastern flank of the Yellowknife Bay syncline are overprinted and reoriented by F_2 folds. F_1 open folds face and plunge southwesterly in low-grade southern rocks whereas further north and east tight F_1 folds are crossed by subvertically plunging F_2 isoclines that accordingly change in direction of facing. F_2 trend easterly and northwesterly in conformity with nearby margins of plutons. An early stage foliation (S_1 or S_2), generally bedding parallel, predominates in schists and migmatic rocks close to plutons. Elsewhere, later S_3 cleavage and minor F_3 folds trend northwesterly and obliquely across F_1 and F_2 folds and bedding. Deformed en echelon sets of quartz veins reflect shear along and flattening across bedding. Veins and sandstone beds near plutons are boudinaged and experienced high strain.

ULTRAMAFIC ROCKS AND PLATINUM GROUP ELEMENTS IN THE NORTHWEST TERRITORIES

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A remarkable increase in the price of platinum (Pt), from $260 U.S. per ounce in the spring of 1985 to over $675 U.S. ($940 Cdn) in early September, 1986 ($600 in October, 1987), has sparked an impressive increase in exploration for platinum group elements (PGEs) worldwide. Exploration has increased significantly in North America, where large amounts of PGEs are consumed but little is produced.

Platinum group elements are mainly found in iron and magnesium-enriched igneous rocks, ie. ultramafic or ultrabasic rocks. These rocks are further subdivided on the basis of mineralogy, texture, tectonic setting, etc. into peridotite, pyroxinite, dunite, picrite, ophiolite, komatiite, kimberlite, and so on. In addition to the gold-PGE association of ultramafic rocks, several geologists (e.g. Pyke) have noted the theoretical and empirical associations of gold with ultramafic rocks. Ultramafic rocks have been found in more than 50 areas of the NWT. Most of these have been found in the last 25 years, some as recently as 1987. Many have varying degrees of potential for PGE, but most have not been adequately mapped, few have been prospected and only the Muskox and Rankin Inlet Intrusions have been explored or studied in detail.

The only PGE production from the NWT was a by-product of a nickel-copper mine at Rankin Inlet between 1957 and 1962. This ore averaged 1.03 g/t Pt and 2.06 g/t Pd. The Muskox Intrusion, a large layered ultramafic intrusion with geological similarities to the Bushveld and Stillwater Intrusions, is the largest, best known, best exposed and most active PGE exploration target in the NWT. Recent preliminary exploration work by the Technigen Platinum Corp.-Equinox Resources Ltd. joint venture discovered two separate massive sulphide showings in

the Muskox Intrusion that assayed up to 10.3 g/t Pt, 44.6 g/t Pd and 3.8 g/t Au.

In 1986, at least six new projects primarily designed to test for PGEs were initiated in the NWT, making PGEs the most popular exploration target after gold. Several PGE claims and projects have been added in 1987, with additional PGE projects currently under consideration.

GEOCHEMISTRY OF SLAVE PROVINCE VOLCANIC ROCKS: CAMERON RIVER VOLCANIC BELT

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Estimated lithologic proportions by area in the combined Cameron-Beaulieu River volcanic belts is basalt-72%, andesite-8%, dacite-2%, and rhyolite-18%. The Cameron River and Sunset Lake subareas are dominantly basaltic, whereas the Tumpline Lake subarea is practically bimodal (basalt-rhyolite). Based on chemical analysis of 41 representative samples, the essential bimodality of the Belt is displayed by SiO_2 histogram with the major peak at 50-57% and subordinate peaks at 59-65% and 73-85% SiO_2.

The AFM pattern for the Cameron River subarea closely resembles that for Yellowknife, both rich in tholeiitic and calc-alkalic mafic flows with minor moderately alkalic felsic association. In sharp contrast, the AFM pattern of the Tumpline subarea reveals a high proportion of comparatively alkali-rich rhyolites. That for the Sunset Lake subarea is transitional between the other two.

Log-log Ni-Sr plots, representing compatible-incompatible element ratios and indicating the relative roles of crystallization differentiation and partial fusion respectively in magma genesis, reveal a complex pattern in which crystallization differentiation is indicated to have played the dominant role.

$[La/Yb]_N$ - $[Yb]_N$ plots indicate that a significant proportion of the felsic volcanic members in the Tumpline subarea especially fall in the low $[La/Yb]_N$ - moderately high $[Yb]_N$ field indicative of fractional crystallization in high-level chambers of magmas derived from a comparatively shallow source. This is supported by Eu/Eu* ratios in rhyolites from Tumpline (0.59) and Sunset Lake (0.52) subareas compared to those from Cameron River subarea (1-12).

In general, felsic metavolcanic rocks in this volcanic belt compare geochemically with the ore-associated Flila-type rocks of the Noranda area. They stand in sharp contrast to those of the Yellowknife volcanic belt.

STRUCTURAL CONTROL OF THE KIGGAVIK URANIUM MINERALIZATION

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KIGGAVIK, an unconformity related uranium deposit, is at the northeastern rim of the Thelon Basin. Geological reserves are in the order of 20 kt U_3O_8 with an average grade of 0.6% U_3O_8 contained in two ore zones, the Main and the Centre Zone.

Drilling started in 1977 with encouraging results; the first drill hole intersected 30 m with 1% U_3O_8. Drilling of the Main Zone was guided by an east-striking VLF anomaly representing a fault zone separating a granite from Aphebian meta-arkose. The picture of the mineralization emerging from this drilling was discontinuous and showed wide variations in grade from section to section with an average on grade of 0.4% U_3O_8. Drilling was discontinued in 1980 and resumed only in 1985 in the Main Zone.

This second drill phase revealed parallel and distinctly cigar-shaped ore lenses, striking 065°. The point of origin of the ore zones at the surface and the distinct 25° plunge to the

east-northeast were found to be determined by the intersection of 090° VLF anomaly with the 065° fault zone.

In the Centre Zone, the mineralization is controlled by the 065° fault zone and probable thrust faults along the lithological contact between orthoquartzite and meta-arkose.

GEOLOGY OF THE HOOD RIVER AREA (76 L NORTH)

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The granitic and gneissic terrane bordering the southern part of the High Lake Volcanic Belt (HLVB) was mapped during the 1987 field season. Two texturally distinct granites underlie much of the area: a medium to coarse-grained biotite granite which varies from massive and homogeneous to strongly foliated (approaching gneissic) and a megacrystic biotite granite. Hybrid rocks constitute zones of mixing between either various granitic phases or granitic and mafic (either intrusive or extrusive) rocks. The latter are spatially associated with volcanic rocks. Many of the dioritic phases found as inclusions or enclaves in the granitic terrane may represent altered or contaminated volcanic remnants. Gneissic rocks comprise both granitic-tonalitic orthogneisses and paragneisses of either volcanic or sedimentary origin. Elongate rafts of banded amphibolite, representing mafic volcanics, are found in the granitic terrane and along the contact between different plutonic phases or within hybrid granitic rocks. Paragneiss of sedimentary origin is found in the southern area and is continuous with amphibolite facies metasediments of the southern HLVB. This paragneiss unit constitutes lit-par-lit gneiss, with pelitic schist layers injected by granitic veins. The unit is folded into upright or shallow plunging isoclinal folds.

Volcanic rocks are found as outliers in the granitic terrane and along the margins of supracrustal belts (e.g. HLVB) and consist of mafic-intermediate pillowed and massive flows and mafic and felsic fragmentals. The outlier in the south-central map area (NTS 76 L/11) is associated with coarse grained leuco-gabbro. In the northwestern (NTS 76 L/13) and eastern (NTS 76 L/9) map areas, volcanic rocks are found in an area previously mapped as either gneissic or granitic rocks (Fraser, 1964). Volcanic rocks in the northwestern area form an elliptical pattern cored by mafic hybrid rocks and partly bounded by highly strained augen gneiss. Volcanics in the eastern area are poorly exposed, but may be continuous with the HLVB.

The area is transected by numerous faults which show evidence of both brittle and ductile deformation. Relative age relationships place the formation of ductile faults, marked by thin (some less than 1 m wide) mylonite zones, prior to that of the brittle faults.

GEOLOGY OF THE RUSSELL LAKE AREA (85 0/4)

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The Russell Lake area, in the western Slave Province, is underlain by metasediments, mafic and felsic metavolcanics and granitic rocks of Archean age. The area was previously mapped by Lord in 1938 and 1939 (Lord, 1963) and the southern half of Russell Lake (85 J/13) was mapped by Henderson (1985). The area is now being explored for gold. This report presents results from 1:20,000 scale mapping carried out in 1987, part of a mapping project initiated in 1986 (Jackson, 1986).

Turbiditic metasediments underlie most of the area and can be subdivided into two main lithologies: a fine grained, relatively thin bedded sequence

that locally contains iron formation and a coarser grained, more thickly bedded sequence that lacks iron formation but contains disseminated pyrite. Iron-rich metasediments vary from red and green argillites that may be hematite, magnetite, carbonate or amphibole-rich to dark grey-black argillites, which may contain garnet, amphibole, quartz-rich nodules, magnetite, pyrite or arsenopyrite. The latter is locally auriferous and is similar to the Lupin-type iron formation. The origin of the quartz nodules is uncertain. They may represent either recrystallized chert nodules or pull-apart chert layers or boudinaged quartz veins. The nodules are found predominantly in argillaceous layers, often in association with iron formation. In thin section they consist of either coarse interlocking quartz grains or polycrystalline quartz (suggestive of recrystallized chert, Henderson, 1985).

Mafic volcanics form thin, elongate units south of Mosher Lake, where they are gold-bearing and to the west of Russell Lake. The latter, which were examined during the 1987 field season, consist of interlayered pillow basalts, pillow breccia, gabbro and minor felsic volcanics. Top determinations within the northern parts of the unit indicate the sequence faces westward. The base of the sequence is locally marked by thin felsic fragmental units and felsic dikes.

Felsic volcanics on the east side of Russell Lake consist of white to pink, massive and fragmental dacite to rhyolite. Fragmental units consist of both tuffaceous rocks (ash?, lapilli and block-sized fragments) and volcaniclastic (reworked) equivalents, which have a sandy, calcareous matrix. The felsic units are similar to the Clan Lake dacite dome complex (Hurdle, 1985). Top determinations within and surrounding the unit are rare but westward younging is indicated by graded beds within volcaniclastic units and sediments on either side of the felsic pile are west facing.

Several small granite stocks have intruded the metasediments and are generally discordant to structural trends within the sediments, but locally form concordant phacolith-like bodies.

Bedding trends within the metasediments are northerly, but swing to both the northeast and northwest, forming broad warps which reflect a late phase of folding. An earlier phase of isoclinal folding is documented by reversals in bedding facing directions. Both shallow and near vertical plunges to small scale isoclinal folds are observed, suggesting two phases of isoclinal folding. Two prominent regional cleavage trends are recorded: a northwesterly trend (counterclockwise to bedding) and a northeasterly trend (clockwise to bedding). Locally an easterly trending cleavage is also noted. Formation of the regional cleavages postdates isoclinal folding. Folding related to regional cleavage formation is restricted to small scale folds and possibly the large scale warping of bedding trends. A pervasive steeply plunging linear fabric, noted on bedding plane surfaces, suggests the presence of an earlier formed bedding parallel cleavage, with the lineation representing the intersection between this cleavage and the regional cleavage. Several ages of quartz vein emplacement are noted, similar to those described by Fyson (1987).

Metamorphic grade, as recorded in the meta-turbidites, ranges from greenschist (sub-biotite grade) to middle amphibolite (cordierite grade) facies. Further delineation of the metamorphic isograd between the two facies indicates a parallelism between the isograd and the border of the surrounding batholiths. The metamorphic peak was attained late in the deformational history as the isograd transects all major Archean structural trends.

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SOUTH NAHANNI RESOURCE ASSESSMENT, DISTRICT OF MACKENZIE: STREAM SEDIMENT, LITHOLOGIC AND GROUNDWATER CHEMISTRY

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Standard stream silts and heavy mineral separates, rock samples, and thermal and cold springs were sampled in 1985, 1986 and 1987 as part of a non-renewable mineral resource assessment of proposed extensions to Nahanni National Park Reserve. Gold anomalies were detected in heavy mineral concentrates, but not silts, in the Nahanni-Karst-Tlogotsho Plateau area. The gold may have been derived from local tetrahedrite-bearing veins, although a continental glacial source is also possible. Tungsten and gold correlate strongly with each other, and are erratically associated with lead-zinc-silver veins but not with zinc in regional background samples. Heavy mineral sampling is essential in geochemical reconnaissance of the northern Cordillera.

Preliminary chemistry of tufa-precipitating, iron-precipitating, granite-hosted, and high-discharge cold springs appears to vary according to lithologic and fault settings. Zn-dominated heavy mineral (not silt) anomalies, and springwater anomalies in Zn, Cd, Ni, Co, Cu and U, are spatially associated in the Meilleur River area. Springwater geochemistry is a useful complement to regional stream-sediment geochemistry.

A PRELIMINARY INVESTIGATION ON THE EXTENT OF GLACIAL LAKE HOOD, NORTHEASTERN DISTRICT OF MACKENZIE, NWT

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The Glacial Map of Canada shows that glacial lakes once filled parts of the James and Hood River valleys. A reconnaissance survey of the Quaternary geology along the Hood and James Rivers confirmed the former existence of a series of late glacial lakes. The deposits along the James River, which are largely small ice-contact deltas, suggest that only proglacial lakes of very limited extent were formed during the last ice retreat. Glacial lake deposits along the Hood River are much more extensive and attest to a greater complexity of sedimentary deposition as the glacial lake evolved during ice retreat. It is proposed that this lake be called "Glacial Lake Hood".

Air-photo interpretation indicates that the Hood River valley was dammed by a glacial lobe covering the lowlands to the east, preventing an initial eastward drainage of the lake. The lake itself would have extended during its maximum stage from latitude 66°32'N to about 67°05'N and from longitude 110°W to almost 112°W. It would have had an irregular shape, as defined by the east-northeasterly course of the Hood River and its northern and southern

tributaries which were once scoured by ice advancing towards the north and northwest.

Numerous deltas at decreasing altitudes represent successively lower water levels which were developed as ice retreated to the south and to the east. During the highest phase at 400 m a.s.l., the lake drained northward through an outlet leading to the James River drainage system, which was free of ice earlier than the Hood River. The spillway into the James River served as the major drainage outlet for lake phases at 390 m, 330 m, and 320 m a.s.l. One or more deltas which are all on the south side of the lake, are associated with each of these phases.

As ice continued to retreat towards the southeast, lake levels dropped below the sill elevation of this outlet, and drainage resumed towards the east. One of the last phases of Glacial Lake Hood was the 300 m a.s.l. and may represent the more elevated nature of the ancestral Hood River as it started to incise itself and follow its present course.

The fact that the lacustrine deltas are restricted to the southside of the Hood River indicates the proximity of large masses of ice south of the lake which acted as the principal sediment supplying agents. Small depressions within the highlands to the north and west of Glacial Lake Hood were no doubt filled by small tongues and islands of stagnating dead ice after the retreat of the main ice sheet, but they appear to have contributed little sediment into the lake.

The positions of deltas and the predominant palaeocurrent directions to the northwest to northeast obtained from subaqueous outwash deposits (cross-bedding and climbing ripples), suggest that deltas, outwash plains and subglacial eskers made a significant contribution to the lacustrine sediments. At several localities, subaqueous outwash, comprising planar and cross-bedded gravels, and massive and rippled sands, grade up into varved fine sands and silty clays. More rarely, the sediments show evidence of cut and fill structures in the upper portions of stratigraphic sections; these channels are associated with the downcutting of streams as the lake level fell.

Additional field investigations in the western half of the lake area will help to determine if there are any previously unrecorded lacustrine deposits which may aid to further define the evolution and extent of Glacial Lake Hood.

LATE QUATERNARY GLACIOMARINE AND MARINE STRATIGRAPHY OF THE BATHURST INLET AREA

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This research project, undertaken during the summer of 1987 to investigate the stratigraphy, sedimentology and paleoecology of glaciomarine and marine sediments exposed in the Bathurst Inlet area, is part of an ongoing Ph.D. thesis project.

The sediments record the evolution of the late glacial period of ice retreat, when glacial sediments were being deposited in the sea, through to the postglacial marine regression in which a typical off-lap sequence is recorded. Glaciomarine facies include successions of massive to well-bedded diamictons, subaqueous outwash sands, and finely laminated silty clay and sandy silt rhythmites. The latter contain various species of foraminifera, bivalves and fish remains, which are being studied. Two glaciomarine deltas along the Western River at 219 m and 228 m a.s.l. confirm the marine limit of about 225 m a.s.l. in the Bathurst Inlet area.

Marine bivalves were found at an elevation of up to 195 m a.s.l., and will hopefully yield radiocarbon ages that date the retreat of ice from this region and the marine incursion. Massive marine silty clay forms the base of a coarsening upward sequence and grades up into

sublittoral, estuarine silty sand rhythmites and littoral sand deposits. These sediments also contain marine micro and macrofossils that are being studied in order to provide paleoenvironmental data, which will contribute to a better understanding of this regional study of the evolution of the marine regression.

DEFORMATION AND PLUTONISM IN THE WESTERN CONTWOYTO LAKE AREA: IMPLICATIONS FOR GOLD EXPLORATION

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The two turbiditic formations of the western Contwoyto Lake area, formerly distinguished by the presence or absence of iron formation, are also distinct in bedding style. The Contwoyto Formation (iron-formation bearing) is typically thinner bedded (0.5-10 cm), while the Itchen Formation is typically thicker bedded (2-200 cm). The Itchen Formation, which has been interpreted to overlie the Contwoyto Formation, interfingers with the basaltic to intermediate Central volcanic belt. These volcanics are not considered correlative with the Point Lake Formation. The supracrustals are intruded by (in relative chronologic order), syn-volcanic gabbros (C1), porphyritic granodiorite (C2), granodiorites and tonalites (C3), diorites (C4), tonalites (C5), and monzo- and syenogranites (C6). The metasediments have experienced four phases of Archean deformation (D_1-D_4), two phases of Proterozoic folding (D_5, D_6) and one phase of Proterozoic brittle faulting (D_7). The most intense phase of folding and cleavage development (D_3) occurred coincidentally with the metamorphic thermal peak. The multiple folding has produced complex fold interference patterns that have been analysed using bedding-cleavage and cleavage-cleavage relations together with the trace of marker beds.

Results of this study of special interest to gold exploration include: 1) expansion of area underlain by Contwoyto Formation; 2) the use of the proposed structural model to predict and/or interpret structural patterns; and 3) the temporal relationship of quartz veining in the area to peak thermal metamorphism.

GLACIAL HISTORY, DISPERSAL TRAINS AND BOREHOLE DATA, BAKER LAKE AREA, NWT

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Near dispersal centres of the Laurentide Ice Sheet the Quaternary geologic record is commonly characterized by marked variation in ice flow directions as well as by relatively thick accumulations of glacial sediments. Because the sediments have undergone a complex history of glacial transport their compositional relationship with bedrock is not necessarily simple and direct. Studies of the ice flow history, glacial dispersal and glacial stratigraphy in the Baker Lake region illustrate how change in the position of one or more ice divides during the course of glaciation has resulted in marked variation in drift composition and in complex patterns of glacial dispersal.

During the course of glaciation one or more dispersal centres of the Laurentide Ice Sheet were located to the north and to the west of Baker Lake, and the last remnants of the Ice Sheet, associated with the Keewatin Ice Divide, likely occupied Pitz Lake basin, southwest of Baker Lake. The resulting patterns of ice flow, as recorded by striae and streamlined landforms, are complex. The most prominent glacial trends are southeastward, south and east of Pitz Lake, and northwestward to westward, to the north and west of the lake. Some of the flow directions are clearly recorded in surficial deposits by variation in the shape and orientation of glacial dispersal trains, and others are indicated by marked compositional change among units in stratigraphic sections.

Prominent glacial dispersal trains can be traced in the surficial deposits for distances of 10 to >100 km from bedrock sources using both lithological and geochemical analysis of till. The trains can mask the compositional expression of underlying bedrock well outside of their source terrain. Near the position of the Ice Divides vertical stratigraphic sequences may record dispersal trains which can be related to changes in ice flow directions.

Dispersal trains can be either metal-poor or metal-rich in their geochemical expression, depending on the composition and volume of bedrock eroded by the ice. Within the Dubawnt basin, for example, Thelon sandstone has contributed large amounts of debris to the ice. A prominent dispersal train of Thelon sandstone clasts extends >70 km southeast of Pitz Lake basin. Because the sandstone is rich in kaolin, dispersal patterns defined by geochemical analysis of the finest fractions of glacial sediments (silt and clay; clay) are characterized by extremely low trace metal levels. North of Thelon River there is a striking increase in nickel and chromium levels within till that is presumed to be related to glacial erosion of ultramafic bodies associated with either the Prince Albert Group or with Archean terrain adjacent to Aphebian metasediments. A regional-scale (100's of kilometres) dispersal train can be traced southeastward from that area towards Hudson Bay.

A complex stratigraphic record of compositional change has been recognized from analysis of overburden cores collected by the Polargas Consortium along a north-south transect across the Baker Lake area. Within some cores there are marked changes in colour, texture and composition among till units that are clearly the product of shift in ice flow direction and can be associated with both regional (100's of kilometres) and local scale (10's of kilometres) dispersal trains recognized in surficial deposits.

Within others, however, the geologic record is more subtle and its interpretation requires careful, detailed examination of sedimentary structures and drift composition. For example, within cores west and north of Pitz Lake there are relatively thin (<50 cm) units occurring some distance above the bedrock that are characterized by only slight change in colour and texture. The units sometimes contain significantly greater amounts of trace metals within the clay fraction than is found in adjacent sediments. Further analysis reveals copper and lead sulphides and tungsten minerals within the sand-sized heavy mineral fraction. The units are interpreted to be of local origin and to have possibly formed as a result of melting out with little disturbance of compositionally distinct bands within the former glacier. They probably are not associated with a change in provenance as a result of shift in ice flow direction. Although the bedrock source of the mineralized grains is not known, their abundance within the drift suggests that they are of local origin.

This work, carried out in the mid-1970s, illustrates the need to correlate surface and borehole information in mineral exploration programs to explain compositional variation in till. Understanding the origins of the marked three-dimensional changes that can occur within till requires an understanding of glacial history and the proximity to former ice divides, patterns of glacial dispersal and the influence of both regional and local scale dispersal trains, and the various processes of glacial erosion, transport and deposition. In terrain typical of this part of the Canadian shield, these observations can only be made effectively by combining regional drift compositional studies with overburden drilling. Drilling techniques are not likely to be cost effective unless methods that can return intact or nearly intact cores are used.

GEOLOGICAL SURVEY OF CANADA CONTRIBUTION TO CANADA-NORTHWEST TERRITORIES MINERAL DEVELOPMENT SUBSIDIARY AGREEMENT 1987-1991

A.R. Miller
Geological Survey of Canada

The Canada-Northwest Territories Mineral Development Subsidiary Agreement, signed in July, 1987, describes three programs, with the Geological Survey of Canada directly involved in the Geoscience Program.

The Geological Survey of Canada will implement geoscience projects costing $2.85 million over four years distributed amongst subprograms of: Regional Geology (34%), Mineral Deposits (29%), Surficial Geology (14%), Exploration Geophysics (13%) and Administration costs (10%).

Seven 1:50,000 scale and more detailed geological mapping projects in the Regional Geology Subprogram (Slave: Contwoyto-Nose Lake map area, Beaulieu River and Cameron River greenstone belts; Churchill: greenstone belts in the Tavani and Baker Lake area; Bear: Mystery Island Intrusive Suite and Muskox Intrusion border zone) are focused on upgrading the stratigraphic, structural and/or petrological data base in areas of current exploration. The Mineral Deposits Subprogram emphasizes: a) gold metallogeny of selected areas in the Slave and Churchill provinces and b) an evaluation of the PGE potential and associated metals in ultramafic and mafic rocks. Additional studies will evaluate the potential of strategic and rare metals in areas of the Slave and Churchill provinces, and the northern Cordillera. Studies on Mississippi Valley type and unconformity-type uranium deposits are also being supported.

The Surficial Geology Subprogram will study the distribution of gold and PGE minerals in glacial till and lake sediments in order to demonstrate their usefulness in exploration. The Exploration Geophysics Subprogram will supply aeromagneticgradiometer-VLF maps for a gold-bearing Archean greenstone belt in Central Keewatin and radiometric-VLF maps in areas that contain gold and beryllium-REE deposits in the Slave Province.

GEOLOGY OF THE 'LOTHROP LAKE' AREA 65 H/4, KAMINAK GREENSTONE BELT: AN ARCHEAN GOLD-BEARING SHEAR ZONE METAMORPHOSED IN APHEBIAN TIME?[1]

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Gold showings in the 'Lothrop Lake' area, southwestern portion of the Kaminak Greenstone Belt, are hosted in sheared Archean Henik Group mafic metavolcanic rocks near their contact with overlying turbiditic metasedimentary rocks. The metavolcanic sequence consists of massive and pillowed units, subordinate recrystallized gabbroic rocks of extrusive or penecontemporaneous intrusive origin and thin interflow hyloclastic breccias and graphitic-sulfidic metasediments. Graded fine to coarse arenaceous greywacke overlies the metavolcanic sequence.

The distribution of schistosity and mineral lineations in metavolcanic-metasedimentary rocks suggests southwest plunging, northeast-southwest trending folds were developed in Archean time. Shear zones in the mafic metavolcanic rocks and along volcanic-sediment contacts parallel fold axes. In Aphebian time, the Hudsonian deformation appears to have amplified Archean structural trends and produced refolded doubly plunging upright and overturned isoclinal folds. Hudsonian metamorphism extended to amphibolite grade and in part outlasted deformation. Shear zones are annealed by randomly oriented hornblende and biotite.

Gold-bearing shears and adjacent wall rocks are characterized by the assemblage: quartz, iron carbonate, plagioclase, arsenopyrite, pyrrhotite, chalcopyrite, pyrite.

[1] Contribution to Canada-Northwest Territories Mineral Development

Agreement 1987-91, project carried by Geological Survey of Canada.

STRUCTURAL AND STRATIGRAPHIC IMPLICATIONS OF MAPPING IN THE NORTHWEST MIRAGE ISLANDS, YELLOWKNIFE BAY, NWT

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Supracrustal rocks of the northwest Mirage Islands are exposed in two domains. In the westernmost islands upper amphibolite grade mafic volcanics, subvolcanic intrusives and turbiditic metasediments form a 700 m wide, north-trending belt (Western Domain). Bedding and cleavage parallel the domain trend, except in the north-central part of the belt where minor folds trend north-westward. The domain is truncated on the west by the Western Granodiorite, and is represented on the mainland to the north as xenoliths within the granodiorite. In the central and eastern parts of the map sheet sub-greenschist to lower amphibolite grade (increasing westward) rocks of similar lithology, with the exception of intermediate to silicic volcanics at the base of the succession, form an east to northeast-trending, south facing homocline (Eastern Domain). The contact between the two domains is not exposed, and the transition between them is marked by a southward deflection of bedding and cleavage in the Eastern Domain. Helmstaedt and Padgham (1986) assigned rocks of the Western Domain to the Octopus Formation, and those of the Eastern Domain to the Banting Group. In this study, rocks of the Octopus Formation are reconsidered as part of the Yellowknife Bay Formation, the youngest member of the Kam Group, which conformably underlies the Banting Group. The two domains differ mainly in metamorphic grade, and partly in structural attitudes, but their primary lithologies are comparable. The justification for a stratigraphic subdivision of the Octopus Formation, which unconformably underlies the Kam Group, and whose occurrence is restricted to the Western Domain, is therefore reconsidered.

THE ELLINGTON VOLCANIC-SEDIMENTARY COMPLEX, GREAT BEAR MAGMATIC ZONE, WOPMAY OROGEN, NWT; ROOTS OF AN ANCHIENT CALDERA

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The Ellington Volcanic-Sedimentary Complex is an isolated volcanic remnant (roughly 300 km^2) in the south-central part of the 1.875-1.86 Ga Great Bear Magmatic Zone (GBMZ), a continental magmatic arc along the western margin of the 2.1 to 1.8 Ga Wopmay Orogen. It consists of lower greenschist facies intermediate to siliceous pyroclastic volcanics with intercalated volcanogenic sediments and subvolcanic intrusive porphyries. Stratigraphic correlations remain uncertain, but on the basis of lithology, geographic position and physical volcanology, the Complex is thought to have formed early, and to be equivalent to the Labine Group, the oldest GBMZ unit in the region. The Ellington Complex is considered to represent deposition in an intra-arc basin or back-arc basin setting, east of the Labine Group (arc proper) during eastward subduction. Significant thicknesses and lateral extent of the sediments suggests that a large scale sedimentary basin separated volcanics of the Ellington Complex from those of the Labine Group stratavolcanoes and caldera complexes exposed to the northwest.

The sediments on the west side of the Ellington Complex are interpreted as lacustrine or fluvial deltaic deposits laid down either in a shallow water intra-arc basin or a back-arc coastal plain along the flanks of the Labine volcanic island arc. In contrast, the sediments on the east are mainly subaerial fluvial deposits and epiclastic wedges. Vent facies lithologies and a predominance of pyroclastic rocks suggest that volcanoes developed locally in the northeast, and the volcanogenic sediments

were probably deposited proximal to subaerial volcanoes. The facies environment is widely varied, as would be expected in any partly submerged volcanogenic terrane, and the supra-crustal rocks are extensively deformed (mainly faulted and locally folded), as would be expected in the core of a tectonically active continental magmatic arc. A well exposed ring dike structure in the northeast, which locally erupted at the surface, suggests that a caldera may have formed within the Ellington basin. This interpretation is supported by a persistent gradual upsection increase of pyroclastic rocks in stratigraphic successions throughout the Complex.

THOR LAKE INITIAL OBSERVATIONS ON THE MINERALOGY OF THE LAKE ZONE

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The Thor Lake rare-metal deposit is 100 km east of Yellowknife within the Blatchford Lake plutonic complex. Investigations of the deposit have centred on two zones, the Be-bearing T-Zone and the Nb and Zr-rich Lake Zone which is being studied.

Field investigations have shown that a significant body of silica under-saturated rocks underlies the Lake Zone as evidenced by at least 150 m of nepheline syenite core. These rocks are extremely variable in terms of magmatic layering, the presence of albite and hematite replacement zones and of nepheline syenite sills. The genetic relationship between the Lake-Zone and the undersaturated rocks is uncertain.

Petrographic studies indicate that microcline, albite, biotite, chlorite and quartz are the major rock-forming minerals within the Lake Zone. Pyroxenes and amphiboles have frequently been replaced by quartz-magnetite or quartz-hematite-carbonate assemblages. Albitization within the groundmass preceded the replacement of mafic minerals by quartz and magnetite. This was followed by the formation of chlorite and biotite and then late-stage fluorite and carbonates. Ferrocolumbite formed fine grained radiating, acicular crystals and needles within fluorite veins. Zr is restricted to well-zoned, and to some degree metamict, zircons. REEs are in allanite, monazite, the bastnaesite group minerals and in an as-yet unidentified REE silicate.

In the undersaturated rocks some nepheline has not been affected by post magmatic alteration and as a result appears primary. But in many other instances it has reacted with albite in the presence of water to form analcite rims. Other minerals present include acmite, albite, sodalite, willemite, a Ca, Mn silicate, a Ca, Na silicate and possibly some Ca, Zr silicates.

Cathodoluminescence studies have shown the existence of blue rims around albite which by analogy with T-Zone rocks are believed to result from Ga enrichment. Similar blue rims have been found surrounding some nepheline grains.

REFOLDING AND UPLIFT FLUID-FOCUSING, MECHANISMS CONTROLLING THE EMPLACEMENT OF TURBIDITE-HOSTED GOLD-BEARING QUARTZ VEINS IN THE SOUTH GORDON LAKE REGION

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Gordon Lake is along a late regional 'refold' within the Burwash Formation meta-turbidites of the Archean Yellowknife Supergroup. Two deformational events (D_3 and D_4) spatially and temporally controlled later quartz veining episodes. These veins have known associations with gold mineralization.

The 'regional' cleavage (S_3) has a strong vertical stretch lineation (L_3), and is probably related to granitic emplacement. Variation in refraction

sense of this cleavage across the region suggests that it was developed during the initial formation of the fold. A crenulation cleavage (S_4), preferentially on the east limb, is related to tightening of the refold with a dextral sense of bedding-parallel shear.

Vein types are directly associated to the D_3 and D_4 deformations:

i) early D_3 veins formed preferentially in the wackes,

ii) syn to late D_3 veins are predominately in the siltstones, and are emplaced along S_3,

iii) late D_3 horizontal veins cross-cut the L_3 lineation and record late extension parallel to the vertical stretch,

iv) late D_3 to early D_4 quartz breccias utilized S_3, S_4 and L_3 as fracture anisotropies, hence forming more continuous zones in the better cleaved siltstones than in the wackes,

v) syn-D_4 veins on the west limb are sub-parallel to S_4, without intense D_4 deformation. Syn-D_4 veins on the east limb are also sub-parallel to S_4, but are intensely deformed by D_4.

Fluid mechanisms that formed these late veins were probably related to metamorphic devolatilization and fracturing during uplift, their focusing being controlled by the D_3/D_4 deformational front.

Additional work undertaken to characterize these veining events include:

a) fluid inclusions studies to investigate T, P, X and ρ of vein/metamorphic fluids, and the relationship of inclusions to vein microstructure,

b) trace and major element geochemistry of select host lithologies and vein samples to examine evidence for metasomatic effects and fluid source/concentrator horizons,

c) oxygen, carbon, and sulphur stable isotope studies to investigate fluid equilibration conditions and geothermometry,

d) K-Ar dating of vein and cleavage micas to estimate the time span of veining and cooling events.

PRELIMINARY REPORT ON GEOLOGICAL MAPPING AT BENIAH LAKE, NWT

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At Beniah Lake, a hornblendic gneiss with well defined quartzo-feldspathic layers may represent a northern extension of the basement Sleepy Dragon Complex. A 1 to 2 km wide, northeast-trending shear zone, which extends into the gneiss, contains large blocks (up to 1 km wide) of variably deformed mafic metavolcanics, platformal meta-quartzites, and serpentinized layered meta-dunites. Away from the sheared margins of these blocks, bedding in the meta-quartzite and pillowed flows in the metavolcanics are vertical, striking northwest with tops to the southwest. Cumulate chromite layers up to 15 cm thick in the meta-dunite parallel the bedding. The gneissosity, the bedding, the flows, and the shear zone fabric are cut by a north-northeast-trending, less commonly north-northwest-trending swarm of 1 to 5 m wide mafic dykes that are metamorphosed to amphibolite grade. Near deformed margins of the dykes, the intruded gneissosity and shear zone fabric are folded about a steep axial surface trending northeast. Later undeformed granitic dykes, also trending northeast, cut the gneissosity, shear zone fabric and the mafic dykes.

UTILITY OF THE AEROMAGNETIC DATA BASE FOR GEOLOGICAL MAPPING AND EXPLORATION IN THE NWT

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Geological Survey of Canada

The aeromagnetic mapping program of the Geological Survey of Canada was initiated approximately forty years ago and has resulted in over 10,000,000 km^2 of survey data to date. The mainland portion of the NWT has been largely covered to approximately 120°W. The major portion of Baffin Island has also been surveyed including the recently completed (1984-85) survey of northwest Baffin Island. The normal parameters for these

surveys have been 800 m line separation and 300 m altitude except in rugged areas such as northern Baffin Island.

As most of these surveys were flown before digital recording was commonly in use, the data were digitized and included in the aeromagnetic data base. These digital data were used to produce the one million magnetic anomaly map series which together with the derived products from the 812 m grid such as Shaded Relief have become standard mapping tools.

Since the data were digitized from the original 1:50,000 or 1:63,360 maps along the flight lines, it is possible to recompile at the original scale or less to produce new presentations such as coloured maps and derived products. An example of this process has been carried out for the Courageous Lake area. The volcanic belt with which the deposits are associated is clearly outlined on the Magnetic Anomaly and Shaded Relief map.

These data have also been combined with industry data, originally compiled by P.H. McGrath, over the Arctic Islands, data from the U.S. Naval Research Lab and the National Oceanographic and Atmospheric Agency in the new 1:5,000,000 Magnetic Anomaly Map of Canada. The resultant 2 km gridded data is also available.

For exploration work more detailed gradiometer/total field/VLF surveys are required since the detail that can be obtained is proportional to the altitude. In high magnetic latitudes the zero contour of the vertical gradient outlines vertical contacts. In addition the effect of shallower sources is emphasized over deeper sources so that the resultant maps closely reflect the surface features such as iron formation which may be associated with gold deposits. The VLF EM data which are usually also recorded, complement the magnetic data by outlining near surface conductors and the contacts between zones of differing conductivity such as volcanic-sediment contacts, an important setting for gold deposits in the Slave province.

COLOMAC GOLD PROPERTY, INDIN LAKE AREA

R. Kim Tyler
Neptune Resources Corp.

The Colomac gold project is approximately 220 km north of Yellowknife. Metavolcanics of the Yellowknife Supergroup are folded about a north-trending axis. Multi-phase diorite to quartz diorite sills intrude fold limbs. Two parallel, near vertical structures of a quartz-albite porphyry phase are gold bearing. Gold is in quartz stockwork stringers and veins along contacts and in quartz margins. The Colomac structure is 6100 m long with an average width of 30 m. The Goldcrest structure is 1500 m long and averages 24 to 30 m in width. The structures are mineralized throughout their lengths with several zones of interest containing higher gold concentrations. Zone 2 of the Colomac porphyry has been defined as having 11.8 Mt at 2.9 g/t as a result of exploration work prior to 1986. During 1987, Neptune Resources Corp. has completed a diamond drilling program to categorize ore reserves and performed an onsite demonstration open pit mine, crushing and vat leaching operation.